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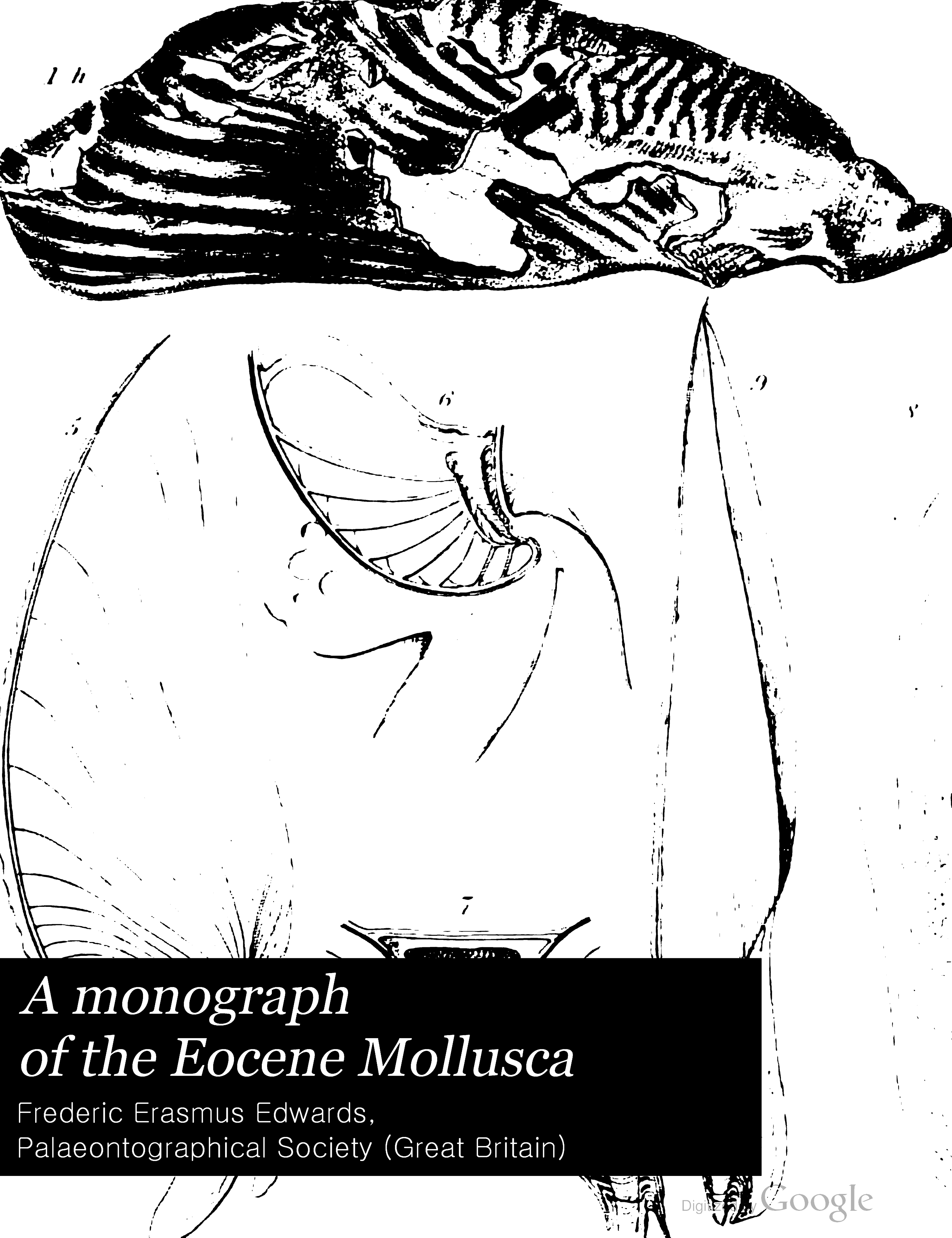

# A monograph of the Eocene Mollusca

Frederic Erasmus Edwards,
Palaeontographical Society (Great Britain)

P. 884.

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# A MONOGRAPH

OF

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# THE EOCENE MOLLUSCA,

OR

## DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES OF ENGLAND.

BY

FREDERIC E. EDWARDS.

## PART I.

## CEPHALOPODA.

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# A MONOGRAPH

OF THE

# MOLLUSCA FROM THE EOCENE FORMATIONS OF ENGLAND.

## FIRST CLASS—*CEPHALOPODA.* CUVIER.

MOLLUSCA BRACHIATA. *Poli.*
CÉPHALOPODES. *Lamarck; Férussac.*
CÉPHALOPHORES. *De Blainville.*

THE Cephalopoda form the first class of Molluscous Animals in the system proposed by Cuvier, and consist of the several encephalous mollusca whose organs of reptation are attached to the head. Possessing an organization more complicated and more fully developed than that of the other molluscs, they have a higher rank in the scale of existence. In a descending series they immediately succeed the Vertebrata.

It is in this class that the latest indication of an internal skeleton will be found. Among the more highly organized of the Cephalopods, the cephalic ganglia, to which, from their importance and development, the term *brain* may still be applied, are surrounded and protected by a cartilaginous process, called *the cranial cartilage*, analogous with the cranium of a vertebrate animal, and in which the muscles of the arms and tentacula are inserted. Other cartilages, subservient to the muscles of the funnel and of the fins, where those organs exist, will be found in other parts of the body, and may be said to represent, in rudiment, those portions of the skeleton which in the vertebrate animals sustain their locomotive organs.

The Cephalopods are eminently social animals; they are all predatory and voracious in the extreme, and appear to be nocturnal or crepuscular in their habits. Some, the more highly organized, inhabit the deep seas only; others frequent the coasts or shallow seas, or conceal themselves in holes in the rocks. M. d'Orbigny, to whose recent work entitled 'Mollusques vivants et fossiles' I am largely indebted, shows that to these various habits the zoological peculiarities of the different genera are referable; and he distinguishes the animals as pelagic (pelagiens), or littoral (côtiers), according to the fact of their frequenting the deep sea or the coasts.

The Cephalopoda have a distinct head, surrounded by arms or tentacula; they possess organs of sight and hearing, closely resembling those of vertebrate animals, and they are endowed with the sense of smell. The eyes are placed on the sides of the head, and in one of the two orders into which the animals are divided (the Dibranchiata) are, generally, lodged in an orbital cavity in which they move freely; in some genera, however, they are united to the outer integument, and are then incapable of motion. When lodged in orbital cavities, they exhibit two distinct modifications, of which M. d'Orbigny has availed himself for the subdivision of the order into two groups (called respectively *Myopsidæ*[*] and *Oigopsidæ*[†]). In the first modification, which is found among the littoral Cephalopods, the eyes are wholly covered by the skin of the head, which becomes thin where it passes over the ball of the eye; in the other modification, which characterises the pelagic species, the orbital cavity is largely open, and the eyes are in contact with the water.

In the tetrabranchiate Cephalopod, whose food is found principally at the bottom of the sea, and to whom enlarged vision would be comparatively useless, the eye is not lodged in an orbital cavity, but pedicillated, and assumes a simpler structure, approaching that of the inferior mollusc.

These animals possess an external auditory opening, generally protected by an external ear more or less complicated in structure. The organs of smell are supposed to reside in certain pores or sacs, opening externally, termed by M. d'Orbigny *aquiferous pores* (ouvertures aquifères), which are divided into *cephalic*, *oral*, *anal*, and *brachial* pores according to their position, and are used by him as generic distinctions. The mouth is terminal, and is furnished with two strong, horny beaks or jaws termed *mandibles*, working vertically upon each other like the bill of a parrot, with which they are usually compared.

The body is inclosed in a thick membranous skin or mantle, united along the belly of the animal so as to form a muscular bag or sac, open at the upper extremity, and containing the branchial apparatus and viscera. In its general shape it is round, or more or less elongated, and cylindrical or depressed. To this body, distinguished as the posterior portion of the animal, the anterior or cephalic portion, consisting of the head and the arms or tentacula it sustains, is attached by one or more ligaments, some internal, others formed by the continuation of the skin of the body, and termed *cervical* or *lateral ligaments*, according to their position. The condition of these ligaments varies with the habits of the animal, and upon it generic characters are founded. They attain their greatest strength in the littoral Cephalopods, and in some genera afford a sufficient attachment between the head and the body; but in the Cephalopods more or less pelagic, in which the free and independent use of the organs of prehension, and a simultaneous active exercise of the bodily locomotive function, would be materially impeded by an extensive permanent attachment, the ligaments are considerably reduced; so much so, in fact, that they would afford a very imperfect guard against the resistance caused by the rapid motion through the water of a mass so large as the cephalic portion of the animal. To obviate this defect, a peculiar apparatus is found in various Cephalopods, which, capable of being instantly brought into action, provides an additional and firm attachment of the head to the body. This apparatus is variable in form, and, except in three genera in which it is not found, forms one of the most certain generic characters. It consists of one or more cartilaginous or fleshy protuberances, placed on each side either of the inner surface of the body or of the base of the head, which fit into corresponding holes or depressions formed for their reception in the opposite part of the head or body. This apparatus, termed by M. d'Orbigny the apparatus of resistance (l'appareil de resistance), has relation to the swimming power of the animal, and is more or less complicated as that increases or diminishes.

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[*] Myopsidæ; from *μυω* claudo, *οψις* visus.

[†] Oigopsidæ; from *ὄιγω* aperio, *οψις* visus.

The respiratory apparatus consists of two or four lamelliferous branchiæ or gills, lodged in chambers contained in the visceral sac, but separated from the viscera by a membranous partition. The number of these gills has been adopted by Professor Owen as an ordinal distinction; and, in the system of classification proposed by him, to which I shall hereafter refer, the Cephalopods are divided into *dibranchiate* and *tetrabranchiate* orders according to the fact of their possessing two or four branchiæ. Into the chambers containing the gills, the water is freely admitted by a valvular aperture, and having served the purpose of respiration, flows, or is forcibly ejected by the muscular contraction of the body, through the excretory tube or funnel (*infundibulum*). The water thus expelled in streams more or less powerful and frequently repeated, at the will of the animal, causes a retrogressive movement, which forms its principal mode of locomotion, from which circumstance the tube itself is called by M. d'Orbigny the *locomotive tube*. The body thus becomes the most important locomotive agent; and as its size and shape must materially influence the retrogressive motion, we can readily conceive that they will have relation to the exigencies of the animal for swimming. Thus the pelagic species, in which the body, from its comparative size, and its cylindrical form and tapering extremity, is adapted to contain a large quantity of water, and to move through the sea with facility, are, as their necessities would require, pre-eminently powerful swimmers; while, on the other hand, in the littoral species, to which great retrogressive power would be not only unnecessary, but a source of frequent injury, the body is small and rounded, or depressed, so as to afford a broad surface on which the animal can rest upon the ground.

Among the dibranchiate Cephalopods the circulation is performed by the agency of a central or systemic heart, of two lateral hearts, subservient to the propulsion of the blood through the branchiæ, and thence called the *branchial* hearts, and of a venous system consisting of two principal vessels, *venæ cavæ*, contained in a cavity called by Professor Owen the *pericardium*, and communicating freely with the branchial chambers, and of other subordinate trunks or vessels. In this cavity terminates the tube called the *siphon* or *siphuncle*, which perforates and traverses the chambers of all the multilocular shells, whether external or internal,* and by means of which, as it has generally been supposed, the animal can diminish or increase the specific gravity of the shell, and so facilitate its rising or sinking in the water.

In the recent *Nautili*, the sole living representatives of the tetrabranchiate Cephalopods, the lateral hearts are wanting, the enlarged surface of the branchial apparatus rendering such additional means of circulation unnecessary.

The funnel or locomotive tube is placed beneath the head, and supports at its base the apparatus for resistance before noticed. Its functions are various; it conveys away the water inhaled for respiration after that object has been served, and, as we have already seen, becomes, at the will of the animal, the principal locomotive agent; it is also the excretory tube. The condition of this organ is used by Professor Owen as an ordinal character; in the dibranchiate Cephalopods the parietes of the funnel are entire, while in the tetrabranchiate Cephalopods they are disconnected along the ventral margins.

A peculiar provision for defence is found among the naked Cephalopods, which is denied to those protected by an external shell; this provision consists of an organ for secreting and expelling an inky fluid, by the effusion of which the animal, when alarmed, is enabled to discolour the surrounding water, and thus to facilitate or conceal its escape. The fluid is contained in a bladder-shaped sac, called the *ink-bladder*, and its presence may be regarded as a certain indication of the dibranchiate type of organization.†

In addition to the retrogressive power possessed by all the Cephalopods, and derived from the agency of the funnel, the decapodous genera are provided with lateral or terminal fins, more or less coriaceous, according as the habits of the animal are more or less pelagic or littoral. The motive function of the fins, however, appears to be secondary; those organs being used chiefly to sustain or steady the animal, and direct its course through the water. The position of the fins is used as a generic character.

The dibranchiate Cephalopods carry on their heads eight or ten arms, the place of which, in the tetrabranchiate Cephalopod, is supplied by a multitude of tentacula grouped around the mouth. These arms or tentacula are organs as well of locomotion as of touch and prehension. In the dibranchiate Cephalopod the arms are furnished with suckers (*acetabula*), and are of two kinds, viz.: eight *sessile* arms encircling the mouth, and connected at the bases by a muscular web more or less broad; and two *tentacular* arms placed one on each side, and capable of considerable extension. The Octopods are furnished with the sessile arms only; the Decapods possess also the tentacular arms. The development of the sessile arms appears to be in inverse ratio with the retro-swimming power of the animal, and, consequently, as we have before seen, with the size of the body. In the pelagic Decapods, which possess the highest retro-swimming power, and whose body is comparatively large, the arms are short; while in the finless Octopods and the littoral Decapods, which have small bodies, and are consequently bad swimmers, and whose habits require the means of creeping along the ground, the arms are infinitely larger, and the connecting web is broader, so that they serve also for reptation.

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* In M. de Blainville's "Mémoire sur l'Animal de la Spirula et sur l'Usage du Siphon des Coquilles Polythalames," the siphuncle is described as a solid tendinous prolongation of the retractor muscles, by means of which the animal is enabled to withdraw the cephalic mass within a cavity formed by the anterior extremity of the mantle, and thus to regulate the specific gravity of the body. It appears, however, from Professor Owen's examination of two specimens of *S. Peronii* (*fragilis*), captured and brought home by Captain Sir Edward Belcher (see Zoology of the Voyage of the Samarang), that the soft or membranous siphon is in reality a *tube* continued from the calcareous siphon and the last chamber of the shell, through a semicircular aperture in the mantle, into the visceral cavity.

† M. d'Orbigny, after referring to these means of escape in the Sepiæ, says (Moll. Viv. et Foss., vol. i, p. 134), that he is far from believing that the faculty is enjoyed by every species; and that, in fact, if it exists among the Sepidæ, it is at the least doubtful among the other Cephalopods, who possess but a small quantity of the liquid, which they only expel when dying.

The arms, to adapt them more perfectly for prehensile purposes, are provided with suckers placed *in serie*, on the inner surface. These are sometimes simple, i. e. *unarmed;* but in some genera they are surrounded by a horny dentated hoop, and in others are *uncinated*, or armed with sharp, horny hooks. When the prey is once seized by this formidable apparatus, escape is hopeless. In the tetrabranchiate Cephalopod, which is always attached to a dense calcareous shell, and whose principal food appears to be the crustacea or testacea living at the bottom of the sea, the complicated mechanism of the arms entirely disappears, and the animal is provided with numerous, small, retractile tentacles, by which the sense of touch, as necessary to it as enlarged vision is to the dibranchiate Cephalopod, is largely developed.

The presence of the sucker bearing arms, or of the tentacula, is an ordinal distinction, and has been adopted by the French naturalists for the designation of the two orders, corresponding with the dibranchiate and tetrabranchiate orders of Professor Owen, into which they have divided the Cephalopods; the armed and unarmed conditions of the suckers are also used as subordinal and generic distinctions, and characters of families and genera are founded upon the retractile power of the tentacular arms.

Exclusive of the impulsion derived from the funnel, and the capacity to rise and float in the sea which the chambered and siphoniferous shell affords, the tetrabranchiate Cephalopod can only creep, like the gasteropods, along the bottom of the sea by means of the free and expanded margin of the anterior extremity of the body.

The animal whose zoological peculiarities have been thus cursorily noticed, is sometimes lodged in a symmetrical shell, *unilocular* or *camerated* (multilocular), that is, presenting a series of chambers divided from each other by thin partitions (*septa*), and successively added by the animal to meet the exigencies of its increasing bulk, and in the last of which the body is contained. The partitions present the greatest variety of form; being in fact moulded upon the animal, they indicate corresponding zoological peculiarities, and generic distinctions have been founded upon them. Among the *Nautilidæ,* one of the families into which the tetrabranchiate Cephalopods are divided, the posterior extremity of the body is round and without any projecting part, or *lobe* as it is termed, and the septa therefore are characterised by simple curvatures or undulations, and their margins are always entire; and thus we are led by analogy to believe, that in the *Clymenidæ* the animal had an angular lobe on each side of the body, from which the sinus, which characterizes their septa, would take its form; and that in the *Ammonitidæ* the posterior extremity of the body had many lobes, the edges of which were foliated, whence the septa assumed corresponding curvatures with foliated margins. Sometimes, and this is most generally the case among the recent Cephalopods, the animal is without the protection of an external shell; but it is then supplied either with a calcareous chambered shell almost wholly buried in the animal, or with a horny or calcareous substance, simple, or more or less complicated in form and structure, wholly internal, and encysted in the back of the mantle. From the presence or absence of the external shell, the Cephalopods have been, and in fact still are, popularly divided into shell-bearing and naked Cephalopods, although in the systematic arrangement proposed by Professor Owen these terms have a more restricted application.

The chambered shells are characterised by a peculiar apparatus, by means of which, as it has been generally supposed, they are made subservient to hydrostatic purposes, although the precise mode by which that end is attained is merely conjectural. From Professor Owen's description of the *Nautilus Pompilius,* it appears that the posterior part of the visceral sac is prolonged in the form of a membranous tube, which, passing through a short calcareous collar, formed in the disc of each septum, and called the *testaceous siphon,* traverses the different chambers to the extreme nucleus of the shell. This tube, with the calcareous collar which, more or less, covers and protects it, is termed the *siphon* or *siphuncle,* and is found in all the multilocular shells strictly so called, whether external or internal, recent or fossil; and its position with reference to the margin of the shell, is used as another distinction between the *Ammonitidæ,* the *Clymenidæ,* and the *Nautilidæ;* being ventral or external, that is, placed near the outer margin, in the Ammonitidæ; central, that is, at or near the middle of the disc of the septum, in the *Nautilidæ;* and dorsal, that is, close to the preceding volution, in the *Clymenidæ.*

The process by which the external shells of the Cephalopods are constructed does not appear to differ essentially from that used by the inferior molluscs. Professor Owen has described the mode of growth in the *Nautilus Pompilius;* and we are led by analogy to the conclusion, that the shells of the extinct *Nautili* and the *Ammonites,* and their various cognate genera, were formed in the same way. In the recent

*Nautilus* the animal is attached to the shell by two large lateral muscles, called the *adherent* muscles, and by a belt or *cincture* of horny matter, which completely encircles the posterior part of the visceral sac, and expands at the sides into broad discs, which serve as the medium of insertion of the adherent muscles; and the prolonged posterior extremity of the visceral sac, forming the membranous siphuncle, is a third mode of attachment. As the animal increases in size, the adherent muscles and the cincture gradually advance their line of attachment, and the membranous tube at the same time lengthening in proportion, a cavity is thus formed between the septum and the lower portion of the visceral sac. A deposition of calcareous matter by the surface of the mantle then takes place, commencing at the sides of the shell, and proceeding towards the membranous tube, round which it is continued backward, and forms the *calcareous* or *testaceous* siphon. Thus, as the animal increases in bulk, the dwelling-chambers are successively formed and converted into air-chambers, by means of which the specific gravity of the shell and its contents is maintained nearly in equilibrio with that of the surrounding water. During the growth of the animal the anterior portion of the mantle secretes calcareous matter, which it deposits in successive layers on the margin of the aperture; and thus the enlargement of the outer wall of the shell is effected. I must add, that the theory of the gradual advance of the adherent muscles and the cincture during the growth of the animal is opposed to the opinion of M. d'Orbigny, who, in his hypothesis as to the function of the siphuncle, noticed subsequently, maintains in effect, that the advance of the muscles (and, I presume, of the cincture also) is periodic.

The Argonaut presents an extraordinary deviation from the general laws which govern all other molluscous animals; inasmuch as the animal, although perfectly free and unattached to the shell it inhabits, is not now considered to be a mere parasite,* as at first was supposed to be the case, but the actual fabricator of the shell; and it is believed that the broad membranes usually termed *vela* or *velamenta*, into which the extremities of the posterior pair of arms are expanded, and which usually envelope the shell, are the organs by which the deposition is effected; the mantle itself, apparently, not being capable of a calcifying secretion.

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* It is foreign to the present purpose to enter into the question as to the parasitism of the *Ocythoe;* the experiments of Madame Jeannette Power, confirmed to a great extent by the observations of M. Sander Rang and M. d'Orbigny, and more recently by those of Mr. Adams, during the voyage of H.M.S. Samarang, are generally considered as removing all doubt as to that animal being the fabricator of the shell in which it is found; and the theory of parasitism is now rejected by nearly all naturalists. A detailed account of the facts ascertained and recorded by Madame Power and M. Rang will be found in M. Rang's Mémoire, published in Guerin's 'Magasin de Zoologie,' and in Madame Power's 'Observations on the Poulpe of the Argonaut,' translations of which are published in the 'Mag. Nat. Hist.,' new series, vols. iii and iv. The observations of Mr. Adams, published in the 'Zoology of the Voyage of the Samarang,' tend to prove that the shell is constructed by the female Argonaut as a nest for receiving her eggs, and protecting them from injury, resembling in some measure the rudimental capsules secreted by many marine Gastropods for the preservation of the embryo. The animal firmly retains possession of this light calcareous shell-nest by means of the broad expanded membranes of the posterior pair of tentacles; but when disturbed or captured, she loosens her hold, and leaving her cradle to its fate, swims about independent of her shell. Having once deserted the nest, it appears that she has not the power, or more properly the sagacity, to re-enter it. Numbers of male Argonauts were taken by Mr. Adams, but always without shells. There are, however, in this theory, difficulties which probably future observation may explain. In the first place, the shells

The beaks or *mandibles* with which the mouths of the Cephalopods are armed, vary in structure according to the habits of the animal. In the dibranchiate Cephalopod, whose principal food consists of fish, the mandibles are sharp, and entirely composed of horn; but, with the tetrabranchiate Cephalopods, the mandibles are blunt, and cased at their extremities with hard calcareous matter, adapted for the crushing of shells, and the defensive coverings of crustacea. The fossil substances called *Rhyncolites*, resembling the mandibles of the recent *Nautilus*, and found associated with the numerous chambered shells so abundant in the secondary and transition formations, appear to be remains of Ammonites, and the other cognate extinct genera by which those shells were inhabited.*

That the external chambered shells of the Cephalopods act in the same way as the swimming bladders of fish, and serve as floats, is obvious from the circumstance that, when deserted by the animal, they swim on the surface of the water. To an animal seeking protection against its enemies, by an instantaneous sinking in the sea, this tendency of the shell to float would prove a serious and dangerous impediment, if the animal itself did not possess the means, in some way or other, of increasing on the instant its specific gravity; and it has long been the opinion of naturalists that the siphuncle is subservient to this purpose, although a difference of opinion has prevailed as to the mode of operation. Dr. Hooke, so far back as the beginning of the last century, expressed an opinion that the *Nautilus* had the power of generating air to fill the deserted chambers, and that by the injection or exhaustion of this air through the siphuncle, the specific gravity of the shell could be diminished or increased. It is ascertained, however, that there is not any communication between the siphuncle and the empty chambers; and Mr. Parkinson, who, in his 'Outlines of Oryctology,' adopts an hypothesis similar to Dr. Hooke's, suggests that the tube is elastic and dilated by gaseous or aqueous fluids, the alternation of which produces a corresponding change in the specific gravity of the shell. Dr. Buckland

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are found in different stages of growth, and they always exhibit the usual indications of successive periodic enlargements. Again, Mr. Adams states, "that it does not appear that the female is able to exist long when disengaged from the shell." How can these facts be reconciled with the theory that the shell is a mere *nidus*?

* MM. de Blainville and d'Orbigny have founded on these remains two genera, which they have named *Conchorhyncus* and *Rhyncoteuthis*. The reasons advanced for supposing that the *Rhyncolites* were not the mandibles of any of the Nautilidæ or Ammonitidæ already known, are far from conclusive; and these genera can only be regarded as arbitrary, though perhaps convenient, divisions, according to the peculiar forms presented by the remains.

maintains that a fluid is contained in the *pericardium,* the position of which is alternately changed from that cavity to the siphuncle; and that in this shifting fluid the hydraulic balance consists, the chambers being filled with air alone, the elasticity of which would admit of the alternate expansion and contraction of the membranous siphuncle. Prof. Owen has pointed out objections to both these hypotheses. The only organ apparently by which the gaseous fluids of Mr. Parkinson's theory can be secreted, is a small artery continued down the siphon, but which would not be adequate for the purpose; and the form and size of the siphon would not allow of an escape of gas so free as to make the consequent sinking of the shell sufficiently rapid for defensive purposes. In some extinct species of *Nautilus* the membranous siphuncle appears to have been capable of considerable dilatation, instances of which are mentioned by Dr. Buckland; but Professor Owen states that, in all the specimens he had examined, the membranous siphuncle, after the first chamber, presented an inextensible and almost friable texture, and was coated beyond the extremity of the testaceous siphon with a thin calcareous deposit; and that, in certain extinct species, the testaceous or calcareous siphon extended from septum to septum, rendering a dilatation of the membranous tube physically impossible. The calcareous siphon of the recent Spirula, as is well known, exhibits this form of structure. It is ascertained that, by the conversion of the dwelling-chambers of the animal into what may be termed air-chambers, the specific gravity of the Nautilus, and of its shell, may be maintained nearly in equilibrio with that of the sea. This equilibrium would be very sensibly affected by the position of the body of the animal with reference to the shell; and Professor Owen therefore inclines to the opinion* that the variation of the specific gravity is caused chiefly by changes in the extent of the surface exposed to the water, according as the body may be expanded beyond the aperture of the shell, or more or less withdrawn within the dwelling-chamber. At the same time it is not improbable that the siphuncle, filled with the fluid propelled into it from the pericardium, in consequence of the pressure caused by the contraction of the animal within the shell, may assist in affecting the specific gravity; it certainly, however, does not appear to be capable of varying the specific gravity of the shell sufficiently for the wants of the animal, and that function, if attributable to it, must consequently be merely secondary. I am therefore inclined to agree with M. d'Orbigny, who rejects the supposition that the action of the siphuncle is hydrostatic. That naturalist assigns to the membranous tube which enters the calcareous siphon, and communicates with the pericardial cavity, a function widely different, and only to be called into action when the animal constructs a new air-chamber. "On this occasion," he says, "many difficulties have to be overcome; the extremity of the body is attached above the last septum (*en dessus de la dernière cloison*) by two powerful muscles; and the animal, always increasing in bulk, must detach its body, and remove and place itself at a determinate distance whenever it wishes to form a new partition. There must also be left, between the penultimate partition and that which the animal is about to construct, a space to be filled with air, while the animal is always under water." And M. d'Orbigny therefore suggests "that the membranous tube and pericardial cavity are required, when the new chamber is constructed, to empty the water contained in it, and to fill it with air before the siphon entirely closes its wall in the interior of the new air-chamber." This hypothesis does not appear to be more satisfactory than the one involving a hydrostatic function. No allusion is made in any way to the attachment of the animal to the shell by means of the *horny* or *epithelial cincture* which, as we have seen, encircles the lower part of the body. This cincture, in fact, hermetically closes the space between it and the last septum; and, unless it is detached, there would not be any external entrance through which the water could penetrate, and the function, the object of the hypothesis, becomes unnecessary. I cannot think therefore that this important attachment was overlooked; and I assume that M. d'Orbigny, when he says that the animal "must detach its body," means that it must detach not only the adherent muscles which he mentions, but also the horny cincture, to which he does not allude. Conceding this to be the case, then, the hypothesis in question assumes that the advance of the body, preparatory to the formation of the new partition, is not gradual; but that the animal, by sudden and nearly simultaneous efforts, detaches the adherent muscles and the cincture, and removes its body to the necessary distance. In all other testaceous molluscs, the advance of the adductor and adherent muscles is caused by the deposition of new matter, by means of a thin membrane, part of the pallial membrane, interposed between the extremity of the muscle and the inner surface of the shell. The deposition is made, particle by particle, on the anterior part of the muscle, portions of the posterior part probably becoming detached and absorbed; but this process is so gradual, that the attachment of the animal to the shell—an attachment, in fact, necessary to its existence—is not affected; and thus the muscle advances slowly and imperceptibly. There does not appear to be any reason for supposing that a law prevails among the cephalopodous molluscs different from that which regulates the advance of the adherent muscle in the testaceous gasteropod. We may readily conceive, on the contrary, that the entire detachment of the muscles and of the cincture would be attended with considerable inconvenience to the animal; for, in that condition, the fulcrum or resisting power by which the animal is enabled to use its tentacles and other organs efficiently, and which is essential to its existence, would be temporarily lost. The sudden removal of the body forward would probably, although it cannot be assumed that it would necessarily, cause the rupture of the membranous siphon, for that organ may be sufficiently elastic to stretch to the required distance; but the rupture is, in fact, required by the hypothesis, and the animal would thus be deprived at once of all its means of attachment to the shell. Neither by this periodic advance would the equilibrium of the specific gravity be maintained. We are warranted, I think, in assuming that the specific gravity of the animal and its shell, without the siphuncular aid, would be most nearly in equilibrio with that of the surrounding sea immediately after the formation of a new septum. Now the growth of the animal would constantly tend to derange this equilibrium, until the period should arrive for the formation of the new septum. The capability of the animal, therefore, to rise and sink would be as constantly fluctuating, unless there existed some mode of compensating for the increasing bulk of the body during the interval between the formation of the penultimate septum and that of the last. This compensation, however, would be provided in the case of a gradual advance of the line of attachment; for the vacated part of the dwelling-chamber, filled with exhalations from the animal, and increasing in size as the body is advanced, would become an air-chamber as effective as if it were inclosed by a new septum; while, on the other hand, a periodic advance of the muscles and cincture would deprive the animal of this mode of maintaining the equilibrium.

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* In this opinion M. de Blainville concurs (Mémoire sur l'Animal de la Spirula, &c.), and he shows that a similar mode is used by the Spirula; the alteration of the specific gravity being effected by the withdrawal of the cephalic mass into a cavity formed by the upper portion of the body.

I have mentioned the rupture of the membranous tube, which would be the consequence of the sudden advance of the body; in fact, the hypothesis which attributes to this tube the function of carrying off the water admitted into the vacated part of the shell by the detachment of the cincture, requires, *ex necessitate*, that the tube should be ruptured in order that the water should enter it; and in that case the membranous siphon in the deserted chambers would consist of detached fragments extending from septum to septum, and which, having fulfilled their object and become severed from the animal, would no longer retain vitality. This, however, is not the fact. The membranous tube is continued entire through all the septa to the extreme air-chamber,* and is a vascular organized substance, provided with an artery and a vein for its nutrition; and it maintains its vitality during the life of the animal. We are compelled, therefore, to think that the function of the siphuncle must be coextensive with the animal's existence. On these grounds, the theory suggested by M. d'Orbigny is not more satisfactory than the hydrostatic theory which he rejects. Whatever the function may be, it is evident that the air-chambers themselves would be as efficient a float without the siphon as with it; and the alteration of the specific gravity, as has been stated, may and in all probability is, effected simply by the animal protruding or withdrawing the cephalic mass from or into the dwelling-chamber of the shell, or, as

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* Professor Owen, speaking of the specimen of *Spirula Peronii* (*fragilis*), brought home by Sir Edward Belcher, says: "On gently raising the exposed portion of the siphon with a needle, the soft siphon was withdrawn, without sensible resistance, from the tube of the hard siphon; the siphon so withdrawn must have reached nearly to the innermost whorl. It exhibited a slight segmentation, answering to the successively sheathed parts of the calcareous siphon."

M. de Blainville has shown to be the case in Spirula, within a cavity formed by the anterior extremity of the mantle. We may reasonably infer, therefore, that to assist in varying the specific gravity is not the principal function of the siphuncle. But, in any view, the preservation of the deserted chambers, as air-chambers, is essential to the motive power of the animal; for it is only by their tendency to float when the cephalic mass is protruded, that the animal is enabled to rise; and this nicely-adjusted counterpoise is maintained, as we have seen, by the addition of new air-chambers, as the animal and the shell increase in size. It is obvious, therefore, that the hydrostatic balance would be destroyed if any one of the deserted chambers were so injured as no longer to act as a float. Now it is known that the shells of the testaceous molluscs are not wholly inorganic substances; but that a vital communication is maintained between them and the animals, and that where this communication ceases, the deserted whorls of the shell lose their vitality and become brittle; the calcareous matter falls off in particles, and the shell is much more susceptible of injury. In *Bulimus decollatus* (*Helix decollata*, Linn.) and other similar shells, in which the earlier whorls are wholly deserted, the animal on withdrawing its body forms behind its extremity a concave septum. In these cases the apex of the shell, no longer necessary, is easily broken off; in which state the shell is said to be *decollated.** In the siphoniferous shells, however, the preservation of the chambers, as air-chambers, is, as we have already seen, essential to the motive power of the animal. It is true that in the Nautilus, the mode of convolution, upon a vertical axis, is admirably adapted to strengthen and protect the first-formed volutions; but in shells not so constructed, and even in those possessing the nautiliform mode of convolution, it would appear to be essential that the vitality should not be lost. How, then, is the necessary communication between the animal and the air-chambers maintained, and the vitality of the deserted shell preserved? It has been shown that the siphuncle traverses the chambers to the extreme nucleus of the shell, and that it is provided with a small artery and vein; and we also learn from Professor Owen's Memoir, that in the Nautilus "a delicate pellicle, distinct from the tube, is continued over the outer part of the testaceous tube, and also over the whole inner surface of the chamber." May we not then reasonably regard the siphuncle with its artery and vein, and the pellicle lining the air-chambers, as the organs destined to maintain the vitality of the shell, and feel ourselves justified in considering this office to be in fact the primary function of the siphuncle? And when we bear in mind that the internal shells, from their terminal or, as in Spirula, their exposed position, are particularly liable to injury from the shocks caused by the retrogressive movements of the animals, we shall find that the hypothesis will be as applicable to them as to the external shells. In the extended series of observations made by Dr. Carpenter upon the microscopic structure of shells, it is shown by that gentleman that the outer covering or shelly mass of molluscous animals is invariably permeated by an organized membrane, and he says (Report Brit. Assoc., 1844, page 9): "I am much disposed to believe that in every distinct formation of shell substance there is a single layer of membrane, and I am further of opinion that this membrane was at one time a constituent part of the mantle of the mollusc." He further represents this membrane to have, more or less, a cellular arrangement, the interstices of which are filled with carbonate of lime or inorganic matter; and, at page 10, he says: "Coupling the appearances which I have myself observed, with the observations of Mr. Bowerbank, on the formation of shell, and keeping in view the general doctrines of cell action which I have elsewhere endeavoured to develope, I am inclined to believe that these cells are the real agents in the production of the shell, it being their office to secrete into their own cavities the carbonate of lime supplied by the fluids of the animal." He does not appear to have extended his researches so far as to determine whether any or what amount of vitality is possessed by these membranes; but from the continuity and intimate connexion of this beautiful network, permeating the entire substance of the shell, we may imagine that some slight degree of vital existence pervades the whole membrane, by which it is possible that the inorganic material is preserved from disintegration. In those shells which appear to have been subject to the erosive action of acidulated waters, or other external agency, such as the apices of *Cerithia* and the umbones of *Cyrenæ*, the part most affected is that which is furthest removed from the main body of the animal; while that part of the shell which is in close proximity with the mantle is not, or at least but little, altered; probably owing to its greater vitality, and to its being the part most essential for the protection of the animal. Not only is the entire formation of shelly matter permeated by an organic membrane, but in some of the shelly coverings of molluscous animals in the order *Brachiopoda,* there is a very peculiar structure, somewhat analogous with what has been before suggested as the especial use of the siphuncular tube in the Cephalopoda. Dr. Carpenter has pointed out that in most, or perhaps in all, of the nonplicated species of Terebratula, the whole surface of the shell is perforated with innumerable pores, into which are inserted vascular portions of the mantle of the animal, of a tubular form, and filled with fluid, which have no communication with the exterior, but are closed at the outer surface of the shell, and occupy the entire space of the pores. These cæcal appendages may be for the purpose of distributing a greater degree of vitality through the body of the shell; though for what especial purpose this provision is required in one group more than another, it is not easy to explain; perhaps a greater degree of strength is required in the *nonplicated* shell, for the preservation of an animal, whose habitation, for the most part, is at a considerable depth, where the pressure of water is much increased, than in the plicated species, the peculiar construction of which would afford sufficient resistance, without that additional support which the smoother species may receive from this singular structure of the mantle. If, however, a necessity exist for the preservation of the shell in ordinary cases, how much more essential would it be that some compensating power should be possessed by an animal whose existence, in all probability, is dependent upon the buoyant principle of its partitioned shell; and how probable does it appear that this, an ordinary provision, should be employed for its protection.

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* I am wholly indebted to my friend Mr. Searles Wood for the following theory as to the siphuncular function, and the main arguments in support of it. The well-known conchological attainments of that gentleman exact respect for every opinion of his on subjects like the present; but independently of this, the theory itself seems to me to be far more probable than any hitherto advanced as to the office of the siphon; and I therefore gladly avail myself of Mr. Wood's permission to introduce his views of the subject into my text.

The tubular character of the siphuncle suggests an hydraulic action. To explain this, it is necessary to invest the animal with the power of emptying and filling the tube at discretion; and this power it may be presumed to derive from the pressure upon the pericardial cavity, caused by the folding and contracting within the shell of the large cephalic mass. Under this pressure the fluid would be injected the whole length of the siphuncle, and, on the removal of the pressure, would return into the pericardium, to be there renovated and vivified with the other fluids, to be again injected when the animal returns within the shell. If the siphuncle had been a solid body, or composed of muscles, fibres, &c., it would have required to be permeated with arteries, blood-vessels, &c., for its sustenance; but by the simple process of the fluid returning into the body of the animal, all the complicated apparatus necessary to sustain a fleshy body is superseded; circulation and renovation are accomplished, and the fluid is thus maintained in a condition capable of affording the nourishment to the shell which the present hypothesis requires.

The theories here suggested are, as all other theories on the same subject must for the present be, merely speculative; for, to quote the observation of Professor Owen,* "much remains to be done before the theory of the chambers and siphuncle can rest on the sound basis of experiment and observation." These alone will satisfactorily determine the real purposes of the membranous siphuncle; but, for my own part, I believe that the primary, and probably the only, function of that organ is to maintain the vitality of the shell, and that it may be looked upon as an elongated cæcum; and that it is not, under any circumstances, used by the animal as a hydrostatic balance.

It is unnecessary here to particularise the various forms of external shells presented by the extinct tetrabranchiate Cephalopods, inasmuch as, of the numerous genera which swarmed in the ancient seas, only the Nautilus survived the secondary period.

The dibranchiate Cephalopods, with the exception of the genus *Argonauta* (which, with *Bellerophon*, constitutes Professor Owen's family of testaceous Octopods), are without external shells; but they are provided with internal horny or calcareous substances, encysted in the back of the mantle, and frequently not in any way attached to the animal, but loose in the cells containing them. In the naked Octopods these internal substances are of the simplest form, and consist of two short, horny, gelatinous styles. Among the Decapods, they become gradually more complicated in structure. In the *Loligidæ*, the *Loligopsidæ*, and the *Teuthidæ*, they assume the form of a horny plate, termed the *gladius*, which in some genera is thin and feather-shaped, or more or less spatulate, lanceolate, or ensiform; and in others, they are elongated, narrow, and terminated posteriorily by a simple cup-shaped appendage. In the *Sepidæ* the shell presents a series of thin calcareous plates, not siphoniferous, but separated by numerous exceedingly minute pillars, and forming a convex mass terminated by a *mucro* or spine; in the *Belemnitidæ* it consists of a chambered cone perforated by a siphuncle, and lodged in a cavity formed in the upper portion of a calcareous rostrum, more or less pointed or obtuse; and in the *Spirulidæ*, the sole remaining family, it is a calcareous, horizontally convolute, multilocular, and siphonated shell, with distinct whorls, and imbedded in the animal, but having portions of the last whorl merely covered by the outer layers of the skin. These differences in structure appear to be always accompanied with distinct zoological forms; and hence the Palæontologist is enabled to form a tolerably correct judgment of the analogy between the existing species and those which inhabited the ancient seas, although the testaceous remains are, most frequently, the only means of comparison afforded to him.

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* Memoir on the Nautilus Pompilius, p. 47.

These internal shells are formed by secretions, from the internal surfaces of the cells, of a horny or calcareous substance, which is deposited in successive layers, and by the continual addition of which they increase in size as the growth of the animal proceeds. Their functions are various, and in accordance with their particular structure. When the internal shell is gelatinous or horny, as in the Octopoda, and in the *Loligidæ*, *Loligopsidæ*, and *Teuthidæ*, the function is chiefly to support and strengthen the body, analogous with that of the bones in the vertebrate animals. It appears that the greater or less length of the shell has always relation to the swimming power of the animal. When the internal shell is horny or calcareous, and contains parts filled with air, as is the case in the several other decapodous families, it acts as a float; and in this function, like the external shell of the tetrabranchiate Cephalopods, it represents the swimming bladder of fish; but the volume of air contained within the shell is, apparently, in an inverse ratio with the swimming power of the animal. In addition to these functions, the internal shells, which are provided with a mucro or rostrum at their posterior extremities, as in the *Sepidæ* and *Belemnitidæ*, are enabled by its means to break the force of the shocks caused by the body striking against any hard substance in its retrograde motion. In the recent Cephalopods this protection is confined to the *Sepidæ*, the most littoral of all the Cephalopods: to the deep-sea swimmers it is denied; it would in fact be useless to them. We may assume, therefore, that in the extinct Cephalopods the presence of the mucro or rostrum will indicate a littoral animal. M. d'Orbigny states that he has always observed in the Sepia, the extremity of the mucro projecting beyond the body, and it is not improbable that this part of the shell may be used, as he suggests, for defensive purposes, and that it is protruded at the will of the animal.

The Cephalopods, highly organized as they are in comparison with the other molluscs, are among the earliest forms of animal life which geology has brought to light. The Silurian group, the most ancient fossiliferous formations with which we are acquainted, contains the remains of one species of Nautilus, and of many species belonging to cognate genera. Several species of Goniatites, an anomalous genus belonging to the *Ammonitidæ*, and connecting that family with the *Nautilidæ*, also occur. As we ascend in the Palæozoic series, we find that various of the primitive genera and species disappear, and are succeeded by other forms, distinct from, although closely allied to, them; which, in their turn, are also lost. On passing into the Mesozoic series a marked change takes place. Of the eight genera constituting the family *Nautilidæ*, which lived during the Palæozoic epoch, Orthoceras[*] and Nautilus alone survive; and of the long series of species belonging to the latter genus, whose remains are found in the carboniferous formations, every one disappears; but an immense array of Ammonites starts into existence, with septa at first comparatively simple, but becoming more complicated in structure in the succeeding formations. The dibranchiate Cephalopods now first appear.[†] In the Oolitic group, twenty-five species of Belemnite, and remains of various genera belonging to the families *Loligidæ* and *Teuthidæ*, have been found. The Belemnites occur in incredible quantities, and sometimes form entire strata. Passing into the Cretaceous group, we still find the Nautilus, though of diminished importance; the Ammonites are reduced in number to little more than a fourth part of the species found in the Oolitic group, and new modes of convolution appear in their shells, on which the several other genera constituting the family *Ammonitidæ* are founded. The family itself gradually diminishes as we ascend in the Cretaceous group, and wholly disappears with the secondary period. The Belemnites appear to be the sole representatives of the dibranchiate Cephalopods during this epoch, and with it they also perish. On entering into the tertiary formations we find, that of the rich and varied assemblage of tetrabranchiate Cephalopods which characterised the fauna of the secondary period, only the *Nautili* survived. On the Continent their remains are found in the Eocene formations, and also in the Miocene formations, at Turin and in Touraine; but in this country they are confined to the older Eocene deposits. Of the dibranchiate Cephalopods, two species of Argonaut have been found in the newer tertiary formations on the Continent; and two genera belonging to the family *Belemnitidæ* occur in the beds of the Paris basin, and in the Eocene formations of England. The remains of one of these last are very closely allied to the recent Sepia, and have been generally referred to that genus. M. Voltz, in his 'Observations sur les Bélemnites,' pointed out certain differences which induced him to propose a new genus, named by him "Belosepia," for their reception. The French Palæontologists reject this genus as having been proposed on insufficient grounds; but, for the reasons stated in a subsequent part, it ought, as it appears to me, to be retained. The other remains found in the Paris basin, connect Belosepia with Belemnite; and the genus *Beloptera* has been established by M. Deshayes for their reception. Both these genera occur in the London clay and in the Bracklesham sands; and they, together with certain remains found in the neighbourhood of London, and described by Mr. James Sowerby in the Mineral Conchology as *Beloptera anomala*, and for the reception of which I have proposed the new genus *Belemnosis*, are the only remains of dibranchiate Cephalopods which as yet have been found in the tertiary formations of England.

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[*] Von Hauer (Nene Cephalopoden aus dem rothen Marmor von Aussee), describes several Orthoceratites associated with Goniatites in the schistose beds of St. Cassian; those beds, I believe, are now generally considered to belong to the Muschelkalk.

[†] The remains described by Goldfuss and Bronn as *Spirulæ*, appear to belong to Gyroceras, a genus of the *Nautilidæ*.

That these animals fulfilled in the ancient seas the office of repressing animal life cannot be doubted. The living Cephalopods are voracious in the extreme; and, as we find that throughout the transition and secondary groups the number of the zoophagous Trachelipods is small in comparison with that of the phytophagous Mollusca, it is not unreasonable to seek in the Cephalopods for that check upon an excessive increase of submarine life, which the other zoophagous molluscs were too inconsiderable in number to afford.*

There is scarcely any class in the animal kingdom of the anatomy and habits of which zoologists have so long remained ignorant, or of which the systematic arrangements proposed have been so conflicting as the class Cephalopoda. Composed, as it is, of animals in their external construction and appearance remote from all others, and widely differing among themselves, we need not feel surprised at the confusion which characterises the older systems, based, as they all were, more or less, on artificial characters, derived from the various conditions of the shell, or from modifications of the dermal system; and the confusion was increased by the introduction among the Cephalopods of numerous microscopic chambered shells, to which M. d'Orbigny gave the name *Foraminifera*, but which the recent investigations of Dujardin show to have been constructed by an inferior class of animals, belonging or allied to the Zoophyta, and which he has named *Rhizopoda*. It would be foreign to the purpose to enter here into any history or comparison of the different systems of arrangement which have been proposed. In the eleventh volume of Lamarck's 'Histoire Naturelle des animaux sans vertèbres,' edited by MM. Deshayes and Milne Edwards the reader will find a most comprehensive and able review of the progress of this branch of natural history.

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* See Dr. Buckland's Bridgewater Treatise, vol. i, chap. xv.

The principle of classification adopted by Cuvier removed many of the difficulties and inconsistencies which had previously prevailed; but it was still based, to a great extent, on external characters. Attempts at arrangements, founded on higher characters, were made by different authors; but the imperfect knowledge which existed of the anatomy of the animals, prevented the establishment of a system in which due regard could be paid to affinities indicated by internal organization. Of late years, however, considerable additions have been made to our knowledge of the anatomy of these animals; and in 1830, the arrival in this country of a specimen of the pearly Nautilus, caught off the coast of one of the New Hebrides, enabled Professor Owen to examine the internal structure of that animal, an opportunity which had not occurred to naturalists since the time of Rumphius. The anatomy of various other Cephalopods was also investigated by Professor Owen; and the additional information thus obtained, led that gentleman, in 1836, to propose a system of classification which, although at variance in many respects with all previous arrangements, was at once received as one founded, in its general principles, on well-defined and natural characters; and this system, accordingly, forms the basis of the more recent classifications.*

All the Cephalopods the anatomy of which had been examined previously to the arrival of the pearly Nautilus, respired by the agency of two branchiæ or gills, and possessed three hearts, a systemic heart, and two lateral hearts; they were also endowed with eight arms furnished with suckers, some genera having also two elongated tentacula or additional arms. The pearly Nautilus, however, was found to be possessed of four branchiæ, and of only one heart; and, instead of arms, the mouth of the animal was surrounded by numerous short tentacula. Availing himself of these natural and well-defined characters, Professor Owen divided the Cephalopoda into two orders: 1st, *Dibranchiata*, comprising those furnished with two gills; and 2d, *Tetrabranchiata,* comprising those furnished with four gills. The Dibranchiata were subdivided into two sub-orders or tribes, according to the number and condition of their locomotive organs; the first tribe (Octopoda) consisting of the Cephalopods with eight arms, having the suckers simple, and the branchial chamber divided by a diaphragm; the second tribe (Decapoda) consisting of those Cephalopods possessed of eight arms, and two additional elongated tentacula. In this tribe the suckers are armed, and the mantle supports two lateral or terminal fins. The "*Octopoda*" were divided into two families, termed "*Nuda*" and "*Testacea,*" according to the absence or presence of an external shell. In the second family was placed *Bellerophon,* an extinct genus proposed by De Montfort for remains peculiar to the Palæozoic series, which Defrance had associated with Argonaut, but which subsequently had been considered as belonging to a heteropodous mollusc. The reasons which induced Professor Owen to restore *Bellerophon* to a place among the Cephalopods are not stated. If however, its remains belong to this class, they present the anomaly of the testaceous Octopods having been without a representative from the end of the carboniferous epoch until the deposit of the newer tertiary formations, when the family reappears in the genus Argonaut. The decapodous Cephalopods were divided into four families, according to the position of the fins, the nature of the internal shell, and the condition of the infundibular cartilage. The ordinal and sub-ordinal distinctions of Professor Owen have been adopted by M. Deshayes, but that naturalist has subdivided the Octopoda and Decapoda each into two groups; the Octopoda according to their possessing one or two rows of suckers, and the Decapoda according to the position of the fins. These characters appear to be of secondary importance, and, by themselves, can scarcely be considered as sufficient for more than generic distinctions. M. d'Orbigny has availed himself of the presence of suckers and tentacles, characters originally proposed by himself and M. Ferussac as ordinal distinctions, and accordingly the Cephalopoda are divided by him into *Acetabulifera* and *Tentaculifera.* The sub-ordinal distinctions of Professor Owen are adopted by this author; but in his subdivision of Octopoda he has drawn his characters from the presence or absence of the apparatus for resistance, and the aquiferous pores. The Decapoda are arranged by him in two groups, according to the modification in the structure of their eyes, to which I have before alluded. The first group (*Myopsidæ*) is divided into three families. In two of these, *Sepidæ* and *Loligidæ,* the characters are taken from the retractile power of the tentacular arms, the condition of the internal shell, and the presence or absence of an eyelid of a part of the auditory apparatus called by him the auricular crests (crêtes auriculaires), and of a superior ligament to the funnel; the character of the third family (*Spirulidæ*) rests entirely on the internal shell. The second group (*Oigopsidæ*) also consists of three families, two of which, *Loligopsidæ* and *Teuthidæ,* depend on the presence or absence of a lachrymal sinus and the auricular crests, on the funnel being or not being provided with an internal valve and ligaments, on the condition of the aquiferous pores, and on the shell being with or without air-chambers. The *Belemnitidæ,* the third family, is separated entirely by the character of the internal shell.

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* Up to this time Spirula, as well as Belemnites, had been classed with Nautilus, and the other Cephalopods which now form the tetrabranchiate order (*Ceph. test. polythalamaces* of Lam.; *Siphonifères* of D'Orb.) Of the anatomy of the animal nothing was known; but the presence of an ink-bag, and the acetabuliferous character of the arms had been shown by Lamarck and Peron; and from this fact Professor Owen, aided by that knowledge of the laws of correlation which imparts such value to all his observations, inferred that the animal must present the dibranchiate type of structure. The accuracy of this deduction is now fully established.

The peculiar modifications in the structure of the eyes among the decapodous Cephalopods appear to be of sufficient importance to justify the subdivision of that sub-order into the two groups proposed by M. d'Orbigny; and inasmuch as the adoption of that division involves the distribution of the genera forming Professor Owen's extensive family *Teuthidæ* between the two groups, and the characters on which M. d'Orbigny has formed his families are at the least of equal importance with those used by Professor Owen, I have adopted the classification proposed by M. d'Orbigny, but with the following modification. That author has placed *Beloptera* and *Spirulirostra* among the *Spirulidæ*. Now the shells of these genera present a series of siphonated air-chambers associated with a rostrum, and therefore bear a much closer affinity with *Belemnite* than with the shell of the recent Spirula. I have, therefore, placed them, as well as *Belemnosis*, among the *Belemnitidæ;* and as I agree with Voltz in considering *Belosepia* to have possessed a camerated and siphoniferous shell, I have also placed that genus in the same family, notwithstanding the close affinity between its remains and the internal shell of the recent Sepia.

# CLASSIFICATION OF THE CEPHALOPODS.

- MOLLUSCA CEPHALOPODA.
  - Dibranchiata (Acetabulifera; *Fer. et d'Orb.*)
    - Octopoda
      - Octopidæ
        - Eledone.
        - Octopus.
        - Pinnoctopus.
        - Cirroteuthis.
      - Philonexidæ
        - Philonexis.
        - Argonauta.
    - Decapoda
      - Myopsidæ
        - Sepidæ
          - Cranchia.
          - Sepiola.
          - Sepioloidea.
          - Rossia.
          - Sepia.
        - Spirulidæ
          - Spirula.
        - Loligidæ
          - Loligo.
          - Sepioteuthis.
          - Teudopsis.
          - Leptoteuthis.
          - Beloteuthis.
      - Oigopsidæ
        - Loligopsidæ
          - Loligopsis.
          - Chiroteuthis.
          - Histioteuthis.
        - Teuthidæ
          - Onychoteuthis.
          - Enoploteuthis.
          - Kelæno (Acanthoteuthis, *Wagn.*)
          - Ommastrephia.
          - Belemnosepia *Agas.* (Geoteuthis, *Muns.*)
        - Belemnitidæ
          - Belosepia.
          - Beloptera.
          - Belemnosis.
          - Spirulirostra.
          - Conoteuthis.
          - Belemnoteuthis.
          - Belemnitella.
          - Belemnites.
  - Tetrabranchiata. (Siphonifera; *Fer. et d'Orb.* Tentaculifera; *d'Orb.*)
    - Nautilidæ
      - Nautilus.
      - Planulites (*Lam*).
      - Gyroceras.
      - Lituitus.
      - Campulites, *Desh.* (Cyrtoceras, *Goldf.*)
      - Phragmoceras.
      - Orthoceras.
      - Actinoceras.
      - Koleoceras (*Portl*).
      - Poterioceras *M'Coy* (Gomphoceras, *Sow.*)
    - Clymenidæ
      - Aturia.
      - Clymenia.
    - Ammonitidæ
      - Turrilites.
      - Helioceras.
      - Goniatites.
      - Ammonites.
      - Crioceras.
      - Scaphites.
      - Ancyloceras.
      - Hamites.
      - Toxoceras.
      - Ptychoceras.
      - Baculites.

### ORDER—*DIBRANCHIATA.* SUB-ORDER—*DECAPODA.*

### *Tribe*—OIGOPSIDÆ.

### 1*st Family*—BELEMNITIDÆ.

The *Belemnitidæ*, the sixth family in the classification proposed by M. d'Orbigny, consist, according to that author, of the genera in which the animal was provided with an internal horny or calcareous shell, having at the *posterior part* air-chambers superimposed in a nearly straight line in the form of a cone, and pierced on the ventral part by a marginal syphon. The family is confined, according to that author, to the three extinct genera, *Conoteuthis*, *Belemnitella*, and *Belemnites*.

The two latter genera, however, do not appear to fall strictly within the terms of the definition; for the posterior parts of their shells consist, as is well known, of a spathose guard, frequently of considerable size, the anterior extremity of which is produced so as to form an alveolus for the reception of the phragmocone. If, as the fact is, the genus *Belemnites* forms the typical genus of the *Belemnitidæ*, it would surely be proper that those genera which, like the type, possess camerated siphoniferous shells, terminated posteriorily by a calcareous guard, should, at all events, be included in the family. It is difficult therefore to conceive on what sound principle *Spirulirostra* and *Beloptera*, but more particularly the last genus, whose calcareous remains present so striking a resemblance to those of *Belemnites*, instead of being placed in this family, have been associated with *Spirula*, with whose spiral discoidal shell they present so little analogy.

It appears to be desirable that, for the present at least, the Belemnitidæ should be extended so as to comprise all the genera in which the animal possessed an internal horny or calcareous shell, with or without a terminal guard, but containing air-chambers pierced by a ventral siphuncle; whether those chambers were superimposed in a nearly straight line in the form of a cone, or in a spiral or subspiral line. As thus enlarged, the Belemnitidæ will consist of the following genera: Belosepia, Beloptera, Belemnosis, Spirulirostra, Conoteuthis, Belemnoteuthis, Belemnitella, and Belemnites.

Hereafter it may be desirable to form a division for the reception of genera in which, as in Conoteuthis, the apex of the sheath is simple.

All attempts at a linear arrangement are absolutely futile; but it will be seen that in this, as in every case where several genera are grouped together, the family presents aberrant forms leading to other groups; thus *Beloptera*, *Belemnosis*, and *Belosepia*, leading to *Sepidæ; Belosepia* and *Spirulirostra* to *Spirulidæ;* and *Conoteuthis* to *Teuthidæ*.

### *Genus* 1*st.* Belosepia.* *Voltz.* 1830.

Sepia. *Cuvier; Férussac; d'Orbigny; Deshayes.*
Belosepia. *Bronn.*

Animal unknown; but, from the affinities between its calcareous remains and the internal shell of the recent Sepia, supposed to have more nearly resembled that genus than any other existing Cephalopod, and may be thus described:

*Body* oblong, (?) naked, supporting two lateral fins extending its whole length; *mouth* terminal, furnished with two corneous mandibles, and surrounded by ten prehensile acetabuliferous arms, of which two were longer than the others; *mantle* free at the anterior margin; *branchiæ* two.

*Shell* internal, oblong, semiconical, coarsely granulated or sulcated on the exterior, internally smooth, containing a series of transverse laminæ, perforated near their ventral margins by large elliptical, sub-siphoniform openings, and terminating in a solid beak or rostrum, inflected towards the dorsal aspect, and expanded at the anterior extremity on the dorsal aspect into an elevated callus, and on the ventral aspect into a semicircular plate bent outwards over the base of the rostrum; the ventral margins of the laminæ converging towards the anterior extremity of the rostrum, and connected by a thin calcareous plate.

*Testâ internâ, oblongâ, semiconicâ, externè granulatâ, internè lævigatâ; septa transversa, foraminibus ventralibus ellipticis subsiphonoidis perforata, continenti, et rostro solido, anticè, parte dorsali in callum proeminentem, parte ventrali in laminam supra rostrum reflexam dilatato, posticè sursum inflexo, terminatâ; septorum marginibus ventralibus ad basim rostri convergentibus et tenui laminâ connexis.*

The remains of this extinct Cephalopod have been long known as of frequent occurrence in the Paris basin; they were noticed by Guettard† and were described by him as the fossil teeth of sharks. They were also figured by Burtin,‡ and by him were considered to be internal bones of a fish's head. To Cuvier palæontology is indebted for pointing out their true character. In a short notice published in 1824, in the 'Annales des Sciences Naturelles,' that illustrious naturalist referred the remains in question to a cephalopodous mollusc closely allied to the recent Sepia; and, in fact, they, as well as the remains of another extinct Cephalopod which exhibited an unquestionably camerated and siphoniferous structure, and for the reception of which the genus *Beloptera* had been established by M. Deshayes, were placed by M. d'Orbigny in that genus. M. de Blainville also in the first instance described them as the remains of a Sepia; but afterwards, when he adopted the genus Beloptera for the *Sepia*

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* Etym. Βελος, telum; Σηπία, sepia.

† Mémoires sur différentes parties des Sciences et Arts, 1783, Septième Mémoire, pl. 2, figs. 29-30.

‡ Oryctyographie de Bruxelles (1784), pl. 2, fig. A.

*Parisiensis*, he confounded with it the remains in question. M. Voltz was the first to examine these remains with the attention they deserve. This author instituted a comparison between the shell of the *Beloptera Belemnitoidea*, that of the *Beloptera Sepioidea* (Sepia Parisiensis), and the recent *Sepion*, and stated the reasons which induced him to consider the *Beloptera Sepioidea* as belonging to a distinct genus, equally removed from the *Beloptera Belemnitoidea* and the recent *Sepia*, and as forming a natural connexion between *Belemnites* and *Sepia;* and he proposed the present genus, *Belosepia*, for its reception. The principal ground advanced by him to justify this separation was, that the remains of Belosepia indicated a camerated and siphoniferous structure in the contents of the sheath, widely different from that of the Sepion; and, if this opinion be correct, there cannot be a doubt as to the propriety of the separation. M. Deshayes, however, in his 'Description des Coquilles fossiles des Environs de Paris,' without questioning in any respect the accuracy of M. Voltz's description, without referring even to that author's opinion as to the siphoniferous structure of the shell, but simply relying on the analogy drawn from the general resemblance between the remains of the *Sepia Parisiensis* and the *Sepion*, unhesitatingly rejected the genus Belosepia as not possessing characters sufficiently distinct from those of *Sepia;* although he considered that it would be desirable to form a section in the genus Sepia for the reception of the fossil species. In this opinion M. Deshayes has been followed by MM. Pictet and d'Orbigny. I cannot concur with these authors in the rejection of M. Voltz's genus. The Belosepion* appears to me to present peculiarities of structure, indicating corresponding important zoological differences, which render it impossible to regard the animal to which it belonged as forming part of the existing genus Sepia.

The Belosepion, like the internal shell of the Sepia, is a compound shell, and consists of—1st, a solid calcareous mucro, or rostrum, commonly called *the beak*, inflected at the posterior extremity towards the dorsal aspect, and at the base expanding on the dorsal aspect into an elevated, compressed, and more or less rugose mass, called by M. Deshayes the *callus*, and on the ventral aspect into a thick semicircular plate, bent outwards, in a radiated fold, over, but not touching, the upper portion of the rostrum, denticulated on the margin, and continued laterally into the parietes of the sheath.

2d. An inverted semiconical calcareous plate, termed the *sheath*, externally coarsely granulated, internally smooth, but presenting a series of undulating impressions, converging towards the inverted apex, where the sheath terminates in a conical cavity, formed in the anterior portion of the rostrum, and strongly inflected towards the ventral aspect, so that the posterior extremity presses against the origin of the radiated fold.

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* The term *Belosepion* is used here to describe the entire internal shell of the *Belosepia;* in the same way as the term *Sepion* (*Sepiostaire* of De Blainville) is used by English writers to describe the internal shell of the *Sepia*, or what is usually known as "Cuttlefish-bone."

3d. A thin calcareous layer, covering the whole of the inner surface and the terminal cavity of the sheath; and

4th. A series of thin laminæ or septa imposed one upon another, at first nearly vertically, but assuming gradually a horizontal direction, owing to the convergence, towards the origin of the radiated fold, of their ventral margins, which are nearly straight, and connected by a calcareous plate, forming the ventral surface of the sheath.

The undulating impressions which appear within the sheath are strongly defined on the dorsal aspect, but become faint as they approach the ventral surface. M. Voltz has described these undulations as impressions of the sutures of the *alveolus;*[*] while, on the other hand, M. d'Orbigny considers them to be lines of growth, and not marks of the chambers, which, he says, in fact only occupied one half of the cavity. They are, however, strictly analogous with the similar impressions found in the *Sepion,* and are formed by the margins of the laminæ or septa. Being formed in succession as the new laminæ are added, it is true that in that way they represent the progressive increase of the shell; but they are not true lines of growth.

The extreme fragility of the laminæ has not allowed of their preservation; but their remains occur, not unfrequently, towards the posterior extremity of the sheath, consisting of fine elevated lines, which traverse the whole circumference of the cavity, and are, in fact, the dorsal and lateral margins of the laminæ adhering to the inner sheath. These lines are continued over the calcareous plate, which connects the ventral margins of the laminæ; and it is evident, therefore, that the laminæ extended across the whole of the transverse area of the sheath.

The ventral margins are always convergent towards the origin of the radiated fold; and, consequently, the laminæ within the terminal cavity slant in a direction opposite to that of the laminæ within the sheath, inasmuch as that the cavity extends wholly below the origin of the fold. Owing to this, the arrangement of the chambers formed by the septa somewhat resembles that of the air-chambers in *Spirulirostra,* except that in the latter shell the plane of the septa is always at right angles with the axis; while in the *Belosepion* it is at an angle more or less acute as the septa approach to, or recede from, the point of convergence. In the cavity itself, the dorsal margins of the laminæ are distant; but as they approach that part of the sheath which is immediately under the point of convergence, they are placed more closely to each other, and they again become distant as the laminæ emerge from the cavity. Owing to the convergence of their ventral margins, the laminæ, which as they emerge are nearly vertical, take a direction gradually more and more slanting towards the anterior extremity of the rostrum, until, on the shell attaining its full growth, they assume a position nearly horizontal. This arrangement of the laminæ is well displayed in fig. 1*h*, Tab. I, drawn from a specimen found at Sheppy, for the use of which I am indebted to Mr. Dixon, to whom it belongs. The ventral margins of the laminæ extend quite across the connecting plate before mentioned; and on each side, at a short distance from the extremities, they expand into the lateral portions of the laminæ, small projecting fragments of which are sometimes still found adhering to the sides of the sheath. It is evident from this that the opinion expressed by M. Voltz, that there existed in each of the laminæ an opening placed near the ventral margin, is correct. These openings appear to have been of an elliptical form, with their shorter axes in a line from the ventral to the dorsal surface, and were lined with an extremely thin calcareous sheath, which extended throughout the whole series of the laminæ, and of which portions are frequently found adhering to the inner edges of the ventral margins and the lateral fragments of the laminæ. This sheath corresponds with the siphon of the Belemnites, and is represented in the Sepion by the calcareous layer which, extending over the posterior edges of the laminæ, covers the entire surface of the last lamina, and it presents, as M. Voltz states, an intermediate form between the narrow, straight siphon of the Belemnites and the wide, open cavity of the Sepion.

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[*] The word *alveolus* is used by this author in its original meaning, and is applied to the chambered cone which Professor Owen has named the *phragmocone.* The term *alveolus* has been with greater propriety restricted by the latter gentleman to the cavity in which the *phragmocone* was lodged.

Whether the spaces between the laminæ were filled with minute columnar partitions, similar to those which characterise the Sepion, or whether they were simple air-chambers, we have not at present any evidence to determine. The probability is, that they were simply air-chambers; for no trace whatever of any substance similar to that termed the spongioid tissue of the Sepion has been found, which, had any such substance existed, might reasonably have been expected; and the true siphonal structure, to which the Belosepion presents so close an approximation, is always associated with simple air-chambers. The Belosepion, as its rostrum indicates, belonged to a Cephalopod eminently littoral in its habits, and the size, notwithstanding the extraordinary development of the rostrum, leads us to believe that the animal was not only smaller, but a less powerful swimmer, than the recent Sepia. We should expect, therefore, to find in it some provision for buoyancy beyond that with which the recent Sepia is furnished, not only for the purpose of increasing the swimming power of the animal, but also as a compensation for the large and dense rostrum and callus which characterise its remains. But if the interlaminar spaces were filled with any substance resembling the spongioid tissue of the Sepion, the floating apparatus of the Belosepion would be apparently inadequate to the wants of the animal. The form and mode of superposition of the laminæ, somewhat resembling the arrangement of the septa in *Spirulirostra*, present a closer analogy with the phragmocone of the Belemnites than with the plates of the Sepion. These considerations give additional weight to the opinion of M. Voltz, founded on the appearance of what he terms the "alveolar sutures," that the Belosepion was a camerated and siphoniferous shell.

The rostrum of the Belosepion presents a structure analogous with that of the spathose guard of the Belemnite. It has a tendency to split in two along the centre, in a vertical plane, from the ventral to the dorsal aspect; and it is composed of successive conical layers, each enveloping the preceding layer, and exhibiting a fibrous texture crosswise. The anterior lateral and dorsal portions present straight plates, longitudinally fibrous, resembling the structure of the *Beloptera Belemnitoidea*, and the external edges hang over each other, and give an imbricated appearance to that part of the rostrum.

In order to appreciate the differences which appear to render it desirable that the genus *Belosepia* should be retained, it may be well to give a short description of the internal shell of the recent *Sepia officinalis*. This will be found to consist of five distinct parts: 1st, an outer layer of calcareous matter, called the *buckler* or sheath, convex, rugose externally, and prolonged at the posterior extremity into a calcareous spine, placed in the medial line, and inflected towards the ventral aspect; 2d, a series of horny layers imposed one over another, extending over the posterior dorsal surface of the buckler, and wholly enveloping and extending beyond the spine; 3d, a thin horny layer spread over the whole of the internal surface, and extending beyond the edges of the buckler, and which, in its turn, is entirely covered by, 4th, a calcareous layer, which contains the spongioid tissue and, 5th, a series of convex horny laminæ, impregnated with carbonate of lime, placed horizontally, the posterior edge of each succeeding lamina being a little withdrawn from that of the preceding lamina, so that by this mode of superposition they present a depression or cavity immediately above the origin of the spine, and gradually rise into a convex mass at the middle and upper extremity of the shell. The spaces between the laminæ act as air-chambers, but there is not any siphuncle or siphonal opening; and the surfaces of the laminæ are studded with an infinite number of minute columnar and sinuous partitions, placed at right angles to the laminæ, and giving them support.

It will be seen from this that the Belosepion, although bearing a close general resemblance to the Sepion, still presents several strongly-defined differences. The elevated calcareous mass or callus, which, in the Belosepion, terminates the sheath on the dorsal aspect, attaining frequently a considerable size, is not found in the Sepion; and the fold, which in the latter is represented by a series of horny layers, distinct from, but wholly enveloping, the spine, is, in the former, a thick calcareous plate, formed by the expansion and retroflection of the anterior extremity of the rostrum, and extending barely beyond the line of the callus. In the Sepion the rostrum is small, in some species little more than rudimentary, and inflected, if at all, towards the ventral aspect. In the Belosepion, on the contrary, it attains a very large size, and, as M. Pictet observes, would indicate a gigantic animal if it were in relation to the animal in the same proportion as the Sepion; and it is invariably inflected towards the dorsal aspect. The internal laminæ of the Sepion are horizontal, equidistant, and parallel, and so arranged as to form a hollow at the posterior ventral portion of the sheath, but rising into an elevated mass towards the middle; while in Belosepion, after emerging from the terminal cavity, in which they radiate, as it were, from the origin of the fold, they are at first nearly vertical, with the edges of the ventral margins ranged in a line with the ventral surface of the rostrum, and converging towards the inverted apex of the sheath; so that, as the sheath enlarges, the dorsal edges of the laminæ become more and more distant, and the laminæ themselves tend gradually towards a horizontal position; and in fact, in an adult individual, the last laminæ become nearly horizontal.

Owing to the different mode of arrangement of the laminæ, the *Sepion* and *Belosepion* differ materially in their shape and general aspect. In each the dorsal plate or sheath is extended so as to embrace the laminæ; but in the *Sepion*, the laminæ of which are horizontal, and placed in a direction nearly parallel with the sheath, it is necessarily much less convex and more extended than in the *Belosepion*, in which the laminæ, being vertical, or more or less vertically inclined, present to it merely their dorsal and lateral margins. The buckler of the *Sepion*, and its contents, are, therefore, in form an elongated oval, depressed in the direction from the ventral to the dorsal aspect, and but slightly convex on the surfaces; while in the *Belosepion* the sheath is considerably shorter, enlarging gradually towards the anterior extremity, and presents a deep semiconical cavity, containing within it the whole area of the laminæ, and it is obliquely truncated at the anterior extremity, and flat on the ventral surface, which does not extend to half the length of the shell. The most important difference, however, is, that the laminæ of the Belosepion possess large ventral, siphonal, or siphoniform openings, a structure which is not found nor represented in the Sepion.

These distinctions indicate corresponding zoological peculiarities; and the animal, although, perhaps, resembling Sepia more closely than any other recent Cephalopod, must yet have presented such marked differences from it as to render it impossible satisfactorily to refer its remains to that genus, and fully to justify the separation proposed by M. Voltz. I have, therefore, retained that author's genus, *Belosepia*, notwithstanding the array of authorities against it; and I have the less hesitation in doing this, when I find that Cuvier did not refer the remains in question to *Sepia*, but to some Cephalopod closely allied to that genus; and that M. de Blainville, when he adopted the genus *Beloptera*, did not hesitate to remove them from the genus Sepia, to which he had referred them, although he placed them, under some misapprehension, in the genus *Beloptera*.

With respect to the place of Belosepia in the systematic arrangement, as the shell presents a camerated and siphoniform structure and a terminal guard, and is therefore more nearly related to Belemnite than the recent Sepia, I have removed it from the family *Sepidæ*, in which M. d'Orbigny has placed it, to the family Belemnitidæ. It seems to have prepared the way for the recent Sepia, and leads from that genus, by a natural and easy transition through Beloptera and Belemnosis, into Belemnitella and Belemnite.

The specific characters are taken from the rostrum, the callus, and the fold. These parts, however, are of secondary importance only, and would vary in form considerably, not only with the age, but probably with the sex of the animal. Distinctions founded upon them, therefore, must necessarily be somewhat vague and uncertain; and, in fact, M. Deshayes, from not attaching sufficient importance to changes resulting from age or other circumstances, has proposed three distinct species, viz. *Belosepia longispina*, *B. longirostris*, and *B. Blainvillii*, on remains which, as well as those of the *B. Cuvieri* (of Deshayes), M. d'Orbigny considers to be varieties of the same species attributable to age.

Four well-defined species are known at present, viz. 1st, B. sepioidea (De Blainv.), consisting of S. longispina, S. longirostris, and S. Blainvillii (Desh.); 2d, B. compressa (De Blainv.); 3d, B. Cuvieri (Desh.), which I consider to be the B. Owenii of Sowerby; and 4th, B. brevispina (Sowerby). With the exception of the B. compressa, which has not yet been found in England, they all occur in the eocene strata of this country. The first three species are found in the Paris basin, and the B. Cuvieri has also been found in the tertiary deposits of Belgium.

**No. 1. BELOSEPIA SEPIOIDEA.** *De Blainv.* Tab. I, fig. 1 *a—i.*

Beloptera sépioidea; *De Blainv.* 1825. Mal. add. et correct. p. 621, tab. 11, fig. 7.
Sepia Cuvieri; *D'Orb.* 1825. Tab. Méth. de la Classe Ceph. p. 67.
Beloptera sepioidea; *De Blainv.* 1827. Mém. sur les Bélem. p. 110, tab. 1, fig. 2, 2*a*, 2*b*.
— — *Sowerby.* 1829. Min. Con. vol. vi, p. 183, tab. 591, fig. 1.
Belosepia Cuvieri; *Voltz.* 1830. Obs. sur les Bélem. p. 22, tab. 2, fig. 6*a—g*.
Sepia Cuvieri; *Galeotti.* 1837. Mém. sur la Constit. Géogn. de la Prov. de Brabant, p. 140.
— longispina; *Desh.* 1837. Foss. des Env. de Paris, p. 757, tab. 101, fig. 4-6.
— longirostris; ,, ,, p. 758, tab. 101, fig. 10-12.
— Blainvilii; ,, ,, ,, ,, fig. 13-15.
— Cuvieri; *Bronn.* 1837. Lethæa Geognostica, p. 1127, tab. 42, fig. 19 *a—c*.
Beloptera longirostrum; *Morris.* 1843. Cat. of Brit. Foss. p. 178.
Sepia longirostris; *Pictet.* 1845. Traité élém. de Paléont. vol. ii, p. 315.
— longispina; ,, ,, ,, ,,
— Blainvillii; ,, ,, ,, ,,
— sepioidea; *D'Orb.* 1845-7. Moll. viv. et fos. vol. i, p. 269.
Belosepia Cuvieri; *J. D. C. Sowerby.* 1849. Dixon's Geol. Hist. of Bracklesham, Selsey, and Bognor, &c., p. 109, tab. 9, fig. 11*a*.
— longirostris; ,, ,, p. 109, tab. 9, fig. 15.
— longispina; ,, ,, p. 109, tab. 9, fig. 12.
— Blainvillii; ,, ,, p. 109, tab. 9, figs. 16, 17.
Non Sepia Cuvieri; *Desh.* Foss. des Env. de Paris, p. 758, tab. 101, figs. 7-9.

*B. rostro elongato, crasso, acuto, recto aut plus minusve arcuato; laminá ventrali crassá, profundè radiatim sulcatá, in margine posteriori denticulatá; callo dorsali profundè et irregulariter rugoso, deorsum producto aut erecto.*

This species presents considerable variations in the form, as well of the callus as of the rostrum; and, in fact, M. Deshayes has separated it into the three species *B. longispina*, *B. longirostris*, and *B. Blainvillii*, chiefly on account of the different conditions of the rostrum. M. d'Orbigny, attributing the variableness of the rostrum to the age of the animal, or to alterations caused by fossilization, to which I would also add changes resulting from attrition, has united these species under the specific name *B. sepioidea*, originally given by De Blainville. Possessing a long series of specimens, comprising individuals in different stages of growth, and in which the peculiarities of form, taken by M. Deshayes as specific characters, appear to pass gradually into each other, I have no doubt as to the propriety of the union, proposed by M. d'Orbigny, of the three species above mentioned. That author, however, has added to them a fourth species, proposed by M. Deshayes, *B. Cuvieri;* but which, as it exhibits constant and well-defined differences, I think should be retained.

The *rostrum* of *B. sepioidea* is elongated, and pointed at its posterior extremity; on the inferior or ventral surface it is sometimes, particularly when young, nearly straight, but more frequently it is bent, at about half the length, in an angle more or less obtuse, towards the dorsal aspect; the dorsal surface presents a sharp cutting edge, slightly arched, and, at its juncture with the callus, exhibits a depression, which is strongly marked in mature specimens. At the base, immediately beneath the callus, it is more or less dilated, and it is angulated at the margins; the ventral surface is more or less convex. The *callus* is narrow, compressed, and deeply rugose; the posterior margin forms an acute angle with the axis of the rostrum, varying considerably in different specimens. In some instances the inclination of the posterior margin is at an angle more or less obtuse with the axis of the rostrum; a condition which, as it appears to me, is attributable to the fracture and attrition of the extremity of the callus, as the specimens in which this form occurs present a smooth worn appearance. The *ventral plate*, immediately beneath the rostrum, is nearly horizontal, but presents a broad undulation, corresponding with the convexity of the ventral surface of the rostrum; the lateral extremities, as they approach the sheath, gradually diminish in breadth, and assume a nearly vertical position. In consequence of this variation in breadth, the ventral plate, which, at the superior margin, is nearly semicircular, presents a regular semielliptical form on the posterior margin. It exhibits on the ventral surface a series of sulci, radiating from the apex of the terminal cavity, and varying in depth; and it is deeply and sharply denticulated on the posterior margin. As the shell enlarges, the plate is thickened considerably by successive layers added to the ventral surface. The last layers frequently do not envelope, but are a little withdrawn from the margin of, the preceding layers, leaving the previous denticulations partly uncovered; and consequently the margin of the ventral plate, in an adult specimen, often presents a double row of denticulations.

The lateral portions of the sheath exhibit deep vascular impressions at the posterior extremity.

The *B. sepioidea* is found plentifully at Bracklesham Bay, on the coast of Sussex; it is also found at Stubbington (near Gosport) and at Sheppy. In France it occurs, according to M. d'Orbigny, in the lower calcaire grossier at Chaumont (en bas), Vivray, and Saint Germain; in the upper calcaire grossier at Chaumont (en haut), Grignon, Courtagnon, Parnes, Muchi-le-Châtel, &c., and, in the sandy beds above the calcaires grossiers, at Tancrou, Aumont, Acy, &c.

The specimen (Pl. 1, fig. 1*h*) exhibits nearly the entire form of the shell; it was found at Sheppy, and enriches the cabinet of Mr. Dixon. The length is four inches, and the breadth across the superior extremity of the sheath, if the cast were perfect, would be rather more than an inch. The remains commonly found seldom consist of more than the rostrum, with, occasionally, portions of the ventral plate, and, more rarely, of the posterior extremity of the sheath. The ordinary size of the rostrum is six tenths of an inch* long, and three tenths wide at the superior extremity.

### No. 2. BELOSEPIA CUVIERI. *Deshayes.* Tab. I, fig. 3 *a—e.*

SEPIA CUVIERI; *Desh.* 1837. Foss. des Env. de Paris, p. 758, tab. 101, fig. 7-9.
— — *Nyst.* 1843. Descr. des Coq. et des Polyp. des Terr. tert. de la Belg. p. 610, tab. 46, fig. 1.
— — *Pictet.* 1845. Traité élém. de Paléont. vol. ii, p. 315.
— SEPIOIDEA (sp.); *D'Orb.* 1845-7. Moll. viv. et fos. vol. i, p. 269.
BELOSEPIA OWENI; *J. D. C. Sowerby.* 1849. Dixon's Geol. Hist. &c. p. 109, tab. 9, fig. 13*a*.
Nec SEPIA CUVIERI; *D'Orb.* 1825. Tab. Méth. de la Classe Ceph. p. 67.
Nec BELOSEPIA CUVIERI; *Voltz.* 1830. Obs. sur les Bélemn. p. 22, tab. 2, fig. 6*a-g*.
Nec SEPIA CUVIERI; *Sow.* Min. Con. vol. vi, p. 183, tab. 591, fig. 1.
Nec BELOSEPIA CUVIERI; *J. D. C. Sow.* 1849. Dixon's Geol. Hist. &c. p. 109, tab. 9, fig. 11*a*.

*B. Testâ extremitate posticali lateraliter dilatatâ; rostro brevi, crasso, arcuato, acuto, ad basim latissimo; laminâ ventrali arcuatâ, profundè sulcatâ, in margine denticulatâ; callo dorsali profundè rugoso, margine inferiori recto aut sursum vergenti.*

M. Deshayes, in his description of this species, refers to Beloptera sepioidea (Beloptère de Cuvier) of De Blainville, and to the specimen figured by Mr. Sowerby in 'Mineral Conchology,' as identical with it. The description given by M. de Blainville is rather sub-generic than specific, and is too general for the purpose of identity; but the figures given by him are evidently those of a mutilated specimen of

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* In stating the size of the shells I have used tenth parts of an inch, in order to facilitate a comparison with the measurements of French shells; as tenths of an inch may be readily, and with sufficient accuracy, converted into "millimetres" by taking 1 tenth as equal to 2½ millim. The exact proportion is 305 millim. = 12 inches; i. e. ·1 in. = 2·54166 &c. millim.

B. sepioidea, and do not correspond with the specific description given by M. Deshayes. Through the kindness of Mr. Sowerby I have had an opportunity of examining the specimen from which his figure was taken, and it is unquestionably a B. sepioidea; the peculiar form of the rostrum being caused by the fracture of the posterior extremity, and the abrasion of the lower part of the outer layers. The present species is well defined by M. Deshayes; and as I have a series of specimens in different stages of growth in which the distinctions are preserved, I do not hesitate to retain it.

The *rostrum* is short, thick, slightly arched, and very broad at the superior extremity; on the dorsal surface, at the posterior extremity, it is compressed, and presents a cutting edge for about one half of the length; the superior extremity is marked by a broad depression extending to the callus. The *ventral plate* is less elliptical, and the denticulations less prominent, than in *B. sepioidea.* The *callus* is nearly perpendicular to the axis of the rostrum, and enlarges rapidly, owing to the greater width of the terminal cavity.

The specimen figured in Mr. Dixon's work, under the name *B. Owenii*, appears to belong to this species. Mr. Sowerby was probably induced, by the synonyms quoted by M. Deshayes, to consider the *Sepia Cuvieri* of that author as identical with the *Beloptère de Cuvier* of De Blainville; and as the specimen before him could not be referred to that species, he proposed the species *B. Owenii* for its reception. The specific name *Cuvieri*, however, having been improperly used by MM. d'Orbigny and Voltz for the *B. sepioidea* of De Blainville, must now be retained for the present species, to which it was applied by M. Deshayes, and it will consequently supersede the name *Owenii* proposed by Mr. Sowerby. M. Nyst cites for his specimens M. Deshayes's description of *B. Cuvieri*, and has, in fact, copied the figures given by that author. I have therefore considered them as identical.

Hitherto, I believe, B. Cuvieri has been found, in England, only at Bracklesham Bay, where it is not by any means common. The French localities quoted by M. Deshayes are Grignon, Courtagnon, Parnes (upper cal. gross.). M. Nyst gives the sandy beds at Boitsfort, Assche, Jette, Forêt, Uccle, and Ghent, as the Belgian localities.

The length of the rostrum is ·3 inch, and its breadth at the superior extremity ·3 inch.

### No. 3. BELOSEPIA BREVISPINA. *Sowerby.* Tab. 1, fig. 2 *a—c.*

BELOSEPIA BREVISPINA; *J. D. C. Sowerby.* 1849. Dixon's Geol. Hist., &c., p. 109, tab. 9, fig. 14.

*B. rostro per-brevi, crasso, acuto, in aspectum ventralem valde convexo et regulariter arcuato; laminâ ventrali profundè sulcatâ, vix denticulatâ; callo dorsali in margine inferiori compresso, sursum vergenti.*

A species much resembling the young of *B. Cuvieri;* but, according to the few specimens we possess at present, it is distinguishable by the shortness and the greater convexity of the inferior surface of the rostrum, and also by the dorsal surface, which is rounder than in *B. Cuvieri,* slants downwards, and, even in the largest specimens, barely presents the cutting edge which distinguishes the two preceding species. The *callus* is longer in proportion, and is so much compressed, as to present a narrow, almost a sharp edge; and it enlarges more rapidly than even in the last species, owing to the greater width of the terminal cavity.

The *ventral plate* is semicircular, and nearly smooth on the inferior margin, and, owing to the width of the cavity, is transversely elliptical on the superior margin; it is also narrower and more deeply sulcated than in *B. Cuvieri.*

The *B. brevispina* is found at Bracklesham Bay, and is very rare. I possess four specimens of different sizes, which all present the same characteristic form; but it is not improbable that a larger series would show that the species is but the young form, or at all events only a variety, of *B. Cuvieri.*

The length of the rostrum is ·2 inch; the width rather less than ·2 inch.

## *Genus* 2d. BELOPTERA. *Deshayes.*[*]

Animal unknown, but supposed to have been closely allied to the Belemnite, which, as described by Professor Owen, appears to have been oblong; the head, surrounded by ten arms, (?)[†] furnished, like those of the recent genus *Onychoteuthis,* with a double alternate series of slender, elongated, horny hooks; mandibles horny; (?) the body purse-shaped, conical, elongated, supporting near the middle two lateral fins, rounded and entire along their free margin; inclosing an ink-bag.

Shell internal, composed of two cones placed apex to apex, united, and expanding on each side into wing-shaped appendages, obliquely inclined towards the ventral aspect; the anterior cone smooth, longitudinally fibrous, hollowed into a deep conical cavity, containing regular transverse concave septa, pierced by a ventral siphon.

*B. Testâ internâ, duobus conis, apice ad apicem conjunctis, formatâ; utroque latere duobus appendicibus aliformis, deorsum inclinatis, sustentâ; superficie dorsali convexâ, ventrali concavâ; cono anteriori lævigato, longitudinaliter fibroso, cavitati conicâ, profunda, septa transversa continenti, excavato; septis concavis, regularibus, siphone ventrali perforatis.*

Guettard, the first author by whom these remains appear to have been noticed, described them as the teeth of fish. Long subsequently, M. Deshayes examined similar remains found in the Paris basin; and, having observed in them characters which induced him to refer them to an extinct Cephalopod nearly allied to the Belemnites, he proposed the present genus for their reception. M. de Blainville, whose 'Manuel de la Malacologie' was then in course of publication, and to whom M. Deshayes had communicated his proposed genus, confounded with the remains in question those of the so-called fossil Sepiæ (Belosepiæ); but in adopting the genus *Beloptera,* he divided it into two sections, the first containing the fossil Sepiæ, which he characterised as species having wing-shaped appendages united at the superior extremity of the rostrum; the second section containing the true Belopteræ, he described as species having the appendages distinct and the cavity conical, and with chambers and a siphuncle. The mistake is continued by M. de Blainville, in the Supplement to his 'Mémoire sur les Bélemnites,' published in 1827. In 1830, Voltz pointed out the differences which rendered it necessary to keep the two genera distinct; and, about the same time, M. Deshayes published, in the 'Encyclopédie Méthodique,' under the article Béloptère, the grounds which induced him to establish that genus. Notwithstanding this publication, however, the error into which M. de Blainville had fallen was repeated by MM. d'Orbigny and de Férussac, in their 'Histoire des Céphalopodes,' and by Cuvier, in his Memoir on the bones of the fossil Cuttle-fish, published in the 'Annales des Sciences Naturelles.'

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[*] Etym. Βελος, telum; πτερον, ala.

[†] The eight *sessile* or normal arms only have as yet been found preserved. Professor Owen states that the traces of the superadded pair of tentacula are somewhat doubtful.

Mr. Sowerby afterwards, when he adopted the genus provisionally for the curious and unique fossil obtained from Highgate, which he published in the 'Mineral Conchology' under the name *Beloptera anomala,* confined the genus to those species which contained a chambered cone like the Belemnites, and referred the species contained in M. de Blainville's first section to the genus *Sepia.* The absence, in the Highgate fossil, of the lateral wing-shaped expansions, and of the blunt terminal rostrum which characterise the two known species of *Beloptera,* as well as other characters to which I shall hereafter refer, seems to me to require the establishment of a distinct genus for the reception of those remains; and the genus *Beloptera* will be then confined to those species which possess lateral expansions, and which, as M. Deshayes himself describes them, exhibit an entire conical and chambered cavity, resembling that of the Belemnite, joined to a terminal rostrum, like that of the Belosepia.

As thus restricted, the *Belopteræ* present, at the anterior extremity, a semiconical cavity, slightly depressed on the ventral aspect, in which was contained a thin calcareous layer, covering the entire inner surface. The inner cone formed by this layer contained a series of transverse, regular, and exceedingly thin septa, traces of which, consisting of their sutures or lines of junction with the inner sheath, are very distinct. These sutures, as they approach the ventral aspect, are slightly bent downwards towards the inverted apex of the cone, and present an acute sinus-like inflection as they rise over a slight linear elevation, which traverses the whole length of the alveolus, along the medial line of the ventral inner surface, evidencing the presence and position of the siphuncle. The opening, or anterior extremity of the conical cavity, is slightly elliptical, having the shorter axis in the direction from the ventral to the dorsal aspect. The margin of the outer sheath is thin and sharp, and its ventral paries is much thicker than the dorsal paries, and rises into an elevated mass, depressed on the surface. The outer sheath itself is composed of a series of concentric layers, and exhibits a fibrous texture, like the sheath of the Belemnite. The apex is prolonged into a dense calcareous mass, strongly inflected towards the ventral aspect, and enlarged towards the posterior extremity, where it becomes attenuated, and is obliquely truncated. This mass is composed of longitudinal laminæ, radiating from the apex of the cone, and so arranged, that the central laminæ are in a plane extending from the ventral surface to the back, and the rest in planes gradually diverging more and more towards the back. The outer edges of the laminæ are distinct and slightly elevated, giving a rough sulcated appearance to the surface. The cone and the calcareous mass into which it is prolonged expand laterally into two smooth semi-elliptical appendages, inclined obliquely towards the ventral aspect, thin and sharp on the outer edges, and gradually thickening as they approach their bases. These expansions consist of two distinct series of layers, deposited on the ventral and dorsal surfaces, and exhibit impressions which, as M. Deshayes remarks, are probably attributable to the presence of a vascular system in the substance of the mantle.

It will be seen from the foregoing description that *Beloptera* presents a much closer analogy with the Belemnites than that exhibited by *Belosepia*. The open semiconical cavity of the latter, in its typical form, nearly resembles the sheath of the Sepion; but the laminæ, both in their mode of arrangement and in their large siphoniform openings, present the first indications towards the phragmocone of the Belemnite. In the aberrant form, *Belosepia compressa*, both the sheath and the laminæ recede a step further from the Sepion type, and prepare the way for, and in fact connect *Belosepia* with, *Beloptera*. In this genus a still nearer approach to Belemnite appears; the wide, open, but shallow sheath of the Sepion, with its siphonless and nearly parallel laminæ, is lost, and is replaced by an entire conical sheath, containing regular transverse septa perforated by a siphuncle, and exactly corresponding with the sheath and phragmocone of the Belemnite. The fold of the Belosepion, formed by the retroflexion and lateral enlargement of the ventral paries of the sheath, largely developed in the typical form, disappears in *Beloptera*, and is represented by the lateral expansions which characterise that genus, and which, greatly reduced in size in *Beloptera Levesquei*, lead directly into the simple sheath of the Belemnite; while the strongly inflected rostrum of the Belosepion assumes the form of a somewhat conical mass, and thus prepares the way for the elongated and regularly conical guard of Belemnite.

Exclusive of the Beloptera anomala (Sow.), for which I have proposed the genus *Belemnosis*, only two species of Beloptera are as yet known, i. e. *B. Belemnitoidea*, and *B. Levesquei*. Both species occur in the Paris basin, and in the Eocene beds of England. The first has also been found at Laeken in Belgium, and at Biaritz.

The specific characters are taken from the conditions of the lateral expansions and of the conical sheath.

### No. 4. BELOPTERA BELEMNITOIDEA. *De Blainville*. Tab. 2, fig. 1*a*—*g*.

TOOTH OF A FISH; (?) *Guettard.* 1783. Mém. sur les Glossopètres, tab. 2, figs. 10, 11, 12.
BELOPTERA BELEMNITOIDEA; *De Blainv.* 1825. Mal. add. et correct. p. 621, tab. 11, fig. 8.
SEPIA PARISIENSIS; *Fér. et D'Orb.* 1825. Tab. Méthod. des Céph., Ann. des Sc. Nat. vol. vii.
BELOPTERA BELEMNITOIDEA; *De Blainv.* 1827. Mém. sur les Bélemn. p. 111, tab. 1, figs. 3, 3*a*, 3*b*.
— — *J. D. C. Sowerby.* 1829. Min. Con. vol. vi, p. 183, tab. 591, fig. 3.
BELOPTERA BELEMNOIDEA; *Voltz.* 1830. Obs. sur les Bélemn. p. 20.
BELOPTERA BELEMNITOIDEA; *Deshayes.* 1830. Encyc. Méthod. vol. ii, p. 135.
— — *Keferstein.* 1834. Die Naturgeschichte der Erdkörpers, &c. p. 430, No. 2.
— — *Deshayes.* 1837, Descrip. des Foss. des Env. de Paris, p. 761, tab. 100, figs. 4-6.
— — *Bronn.* 1837. Lethæa Geog. p. 1129, tab. 42, fig. 18*a-b*.
— — *Fér. et D'Orb.* 1839. Céph. Acetab. Seiches, tab. 3, figs. 7-9; tab. 24, figs. 11-12.
— — *Nyst.* 1843. Descr. des Coq. et des Polyp. foss. &c. p. 612, tab. 6, fig. 2.
— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 316; tab. 14, fig. 2.
— — *Deshayes.* 1845-6. 2d Edit. de l'Histoire Nat. &c. p. 243.
— — *D'Orb.* 1845-7. Moll. viv. et foss. vol. i, p. 308, tab. 14, figs. 1-4.
— — *J. D. C. Sowerby.* 1849. Dixon's Geol. Hist. of Bracklesham, &c. p. 109, tab. 9, fig. 18.

*B. testâ ovato-elongatâ, longitudinaliter recurvâ; supra convexâ; subtus concavâ, depressâ; cavitate anticâ sub-cylindricâ: rostro obtuso, striato: appendicibus lateralibus magnis, semicircularibus.*

Shell oblong, compressed; the sheath straight and nearly elliptical; the ventral paries considerably thickened and depressed on the medial line below the siphuncle, so as to present an elevated sub-quadrate ridge, bifurcated at the posterior extremity. The rostrum enlarges gradually for about two thirds of the length, and then diminishes towards the extremity, which, in young specimens, is nearly conical in form, but in adult ones becomes very obtuse, probably from attrition; it is inflected towards the ventral aspect whence the shell presents longitudinally a somewhat arched appearance. The lateral expansions are inclined towards the ventral aspect, and give a convex form to the dorsal surface, and a corresponding concavity to the ventral surface; they are thick at the juncture of the rostrum and sheath, and become gradually thinner as they enlarge, presenting a sharp cutting edge on their free outward margins. In this, the typical species, they are largely developed, regular in form, and vary considerably in size according to the age of the individual; in young specimens they present an elongated semielliptical form, which, as the shell advances towards maturity, becomes nearly semicircular.

Figs. 1*f* and 1*g* represent a variety in which the inferior cone is shorter, broader, and more compressed, and the wings are wider than in the ordinary specimens.

The *B. Belemnitoidea* is found in England at Bracklesham Bay, where it is somewhat rare. In France it is found in the nummulitic bed at Biaritz, in the Lower Pyrenees; the lower beds of the calcaire grossier at Vivrais, Grypseuil, and Pouchon (Oise), and, in the middle beds, at Grignon, Parnes, Muchi-le-Châtel, Chaumont, &c. It also occurs in Belgium, in the sandy beds at Laeken.

The size is eleven lines in length, and four lines and a half in width across the widest part of the lateral expansions.

### No. 5. BELOPTERA LEVESQUEI. *D'Orbigny.* Tab. 2, fig. 2*a*—*e*.

BELOPTERA LEVESQUEI; *D'Orb. et Fér.* 1839. Céphal. Acetab. Seiches, tab. 20, figs. 10-12.
— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 316.

*B. testâ oblongo-elongatâ, arcuatâ, subtus carinatâ, lateribus depressâ, sub-excavatâ; anticè cylindrico-angustatâ: rostro obtuso, striato: appendicibus lateralibus parvis, linearibus.*

Shell elongated, arched: the sheath straight and nearly cylindrical; the ventral paries thickened, and laterally much compressed, so that, instead of the flat square-shaped, bifurcating ridge which distinguishes the preceding species, it presents along the middle of the sheath, beneath the siphuncular line, a somewhat acute angular keel, which is continued on the upper part of the rostrum, and the sides of which are a little depressed. The rostrum itself is larger, and is transversely more compressed, and less inflected towards the ventral aspect, than that of *B. Belemnitoidea.*

M. d'Orbigny describes the species as destitute of lateral expansions; but, in the figures given by him, there are unquestionable indications of those appendages, very slightly developed it is true, yet still representing the wing-shaped expansions which characterise the genus. In one of the two English specimens, the only two with which I am acquainted, and for the use of which I am indebted to Mr. Wetherell, the lateral expansions are broken away, but their existence is evidenced by a deep suture on each side where they were inserted into the shell. The other specimen unfortunately is broken off just above the juncture of the sheath with the rostrum, at the precise part at which the expansions would first appear; but their presence is indicated by a slight curve in the outline caused by their origin. I do not hesitate, therefore, to attribute to this species the characteristic lateral enlargements, although they are very feebly developed.

M. Deshayes, in his 'Description des Coquilles fossiles des Environs de Paris,' mentions a specimen in his possession, too much mutilated for description, in which the rostrum is smoother and more elongated, and the wings appear to be much narrower than in B. Belemnitoidea, and not to be inclined downwards as in that species; and for which, when better known, he thinks it will be necessary to form a new species. May not that specimen be referred to this species, which has been established since the publication of M. Deshayes's work?

The English specimens of this species have hitherto been found only at Highgate, and are exceedingly rare. In France, according to M. d'Orbigny, the species occurs only in the lower strata of the Paris basin; that is to say, in the sands below the nummulite bed, at Thury-sous-Clermont, Gilocourt, and Cuise-Lamotte (Oise).

The size is twelve lines long and three lines wide.

### *Genus* 3d. BELEMNOSIS.* *F. E. Edwards.*

BELOPTERA; *J. D. C. Sowerby.*

*Animal* unknown but supposed to be closely allied to the Belemnite.

*Shell* internal, oblong, semiconical, with the apex inflected towards the ventral aspect, and enlarged into an obtuse umbo, pierced by a pore on the ventral surface; the anterior part hollowed into a deep semiconical cavity extending to the pore, and having the inner surface covered by two calcareous sheaths, one within the other, continued over the ventral surfaces of, and enveloping, a series of transverse septa, perforated by a ventral siphon.

*Testâ internâ, oblongâ, semiconicâ, apice deorsum inflecto et in umbonem obtusum, foramine perforatum, dilatato; parte anteriori in cavitatem semiconicam, profundam, ad foramen tendentem, et septa transversa, siphone ventrali perforata, continentem, excavatâ; cavitatis superficie duobus laminis conicis, pertenuibus, circa septa productis et ea involventibus, obtectâ.*

The remarkable remains for the reception of which I propose the present genus are described by Mr. J. Sowerby in the 'Mineral Conchology,' and are referred by that author to *Beloptera*. M. Deshayes, in the first instance, in the 'Description des Coquilles fossiles, &c.,' expressed an opinion that they could not be placed in that genus; subsequently, however, in the notice of the genus Beloptera, introduced in the second edition of Lamarck, after speaking of *Belop. Levesquei*, he refers not only that species but also the *Beloptera anomala* of Sowerby to the genus Beloptera, the principal character of which he states to be the association of a conical chambered cavity, similar to that of the Belemnites, with the beak (rostrum) of the Sepia. M. d'Orbigny also (Moll. viv. et foss.) refers to that genus the remains in question, which, he says, resemble *Beloptera Levesquei* in the absence of the lateral wings, but are distinguished from it as well by the want of the under part (the ventral paries) of the shell and of a distinct beak, as by the air-chambers being apparent on the under side. These remains unquestionably bear a close affinity to Beloptera; but the peculiarities they present appear to me to separate them distinctly from that genus, and fully to justify the establishment of a new genus for their reception.

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* Etym. Βελεμνον, telum; ενωσις, conjunctio.

The shell of *Belemnosis* consists of an elongated semiconical sheath, the apex of which expands into a short semicylindrical umbo, pierced on the ventral surface, and inflected towards the ventral aspect. The sheath is convex on the dorsal surface, and is without a ventral paries; the margins at the superior extremity are narrow, and present outwardly sharp edges, which extend rather more than one third of the length of the shell; as the margins approach the inferior extremity they expand, and the inner edges gradually become nearer to each other, until they unite immediately above the umbonal pore. The margins of the pore are elevated, and the pore itself penetrates to, and communicates with, the air-chambers. The septa are transverse and concave; the presence of a siphuncle and its ventral position are indicated by angular inflections on the sutural impressions along the medial line of the ventral surface; the septa are contained in, and wholly enveloped by, a thin conical sheath, which also is covered by a second and somewhat thicker conical layer lodged in the outer sheath.

The principal character of *Beloptera*, viz., the association of the elongated rostrum of the Sepion with the phragmocone of the Belemnite, fails in *Belemnosis;* and the lateral expansions which, assuming their fullest development in *Beloptera Belemnitoidea*, still characterise *B. Levesquei*, although reduced in that species to prominent carinæ, are here wanting, or, at the utmost, are but feebly represented by the sharp outer edges of the ventral margins of the sheath. In *Beloptera*, the outer cone, which contains the inner sheath and its contents, and which exactly corresponds with the phragmocone of the Belemnite, is entire; whereas, in *Belemnosis*, the ventral paries is wanting, or very thin. In this respect *Belemnosis* presents an analogy with *Belemnitella* (D'Orb.), a genus of the Belemnitidæ, characterised by a fissure in the phragmocone communicating with the external paries of the alveolus. This peculiar form of Belemnite at present appears to be confined to the upper chalk formation, and it would seem to connect the true Belemnite with the present genus, in which the fissure becomes largely expanded, resembling the wide cavity of Belosepia. Thus the transition from *Belosepia*, through *Belemnosis* and *Belemnitella*, into *Belemnite* will be easy and natural, and the chain of connexion between the latter genus and the recent *Sepia* will be complete.

The principal character, however, which distinguishes *Belemnosis* is the aperture forming a communication between the alveolar chambers and the sac in which the shell was lodged. In all the camerated siphoniferous shells, I believe without exception, the inferior extremity of the alveolus and phragmocone is perfectly closed, and the air-chambers have not any direct communication with the pallial sac; and, in fact, communicate only with the pericardial cavity by means of the membranous siphuncle. Walch, it is true, in his 'Recueil de Monumens, &c.,' figured a Belemnite, which he described as having a small circular hole at the extremity of a curved point; upon which figure, with embellishments of his own, De Montfort proposed the genus *Paclites,* referred to by Parkinson, and quoted by De Blainville. This genus, however, is universally rejected, as founded on characters merely accidental or imaginary. M. d'Orbigny states, that in certain exceptional cases the extremities of the rostra of Belemnites, at the last period of their growth, form tubular prolongations, and that they are also liable to distortion from accident. The extreme points of the successive layers, which form the spathose guard, are apparently, in some instances, more susceptible of disintegration than the other parts, and thus tubular openings may be formed along what Voltz terms the *apicial line.* But in all these cases the pore is merely terminal, and does not extend far up the sheath. The structure found in *Belemnosis,* therefore, appears to be peculiar to it; and would indicate an application of the siphuncular function, whatever that function may be, different from that in all other siphoniferous shells, and suggests a corresponding peculiarity in the organization of the animal.

From the absence of the elongated rostrum which characterises the *Belosepia* and *Belopteræ,* we infer that the animal of *Belemnosis* was not littoral in its habits, but existed in a comparatively deep sea; and the occurrence of the unique specimen, upon which the genus is founded, at Highgate, where the organic remains indicate a shallow-sea deposit, is attributable most probably to the casual drifting of the animal.

### No. 6. BELEMNOSIS PLICATA. *F. E. Edwards.* Tab. 2, fig. 3*a*—*e*.

BELOPTERA ANOMALA; *Sowerby.* 1829. Min. Con. vol. vi, p. 183, tab. 591, fig. 2.
— — *Morris.* 1843. Cat. of Brit. Foss. p. 178.
— — *Pictet.* 1845. Traité élément. de Paléont. tom. ii, p. 316.
— — *Deshayes.* 1845-6. 2d Edit. de l'Hist. Naturelle, &c. par Lam.
— — *D'Orbigny.* 1845-7. Moll. viv. et foss. tom. i, p. 309, tab. 14, figs. 8-10.

*B. testâ oblongo-elongatâ, supra convexâ, umbone obtusissimo, lateraliter compresso, et deorsum leviter inflecto terminatâ: marginibus ventralibus anticè depressis, posticè sub-convexis, facies externas acutas, internas, obliquè triplicatas, præbentibus: foramine umbonali circulari.*

This shell is oblong, regularly convex on the upper surface, and terminated by a very obtuse, short umbo, compressed laterally, and slightly inflected towards the ventral aspect. The ventral margins are depressed, and present outwardly sharp edges, which extend rather more than one third of the length of the shell; the margins assume a convex form as they approach the inferior extremity, and at about two thirds of the length, become and continue nearly parallel until their union above the umbonal pore. The inner edges present three obscure, very oblique folds, from which character the specific name is taken. The umbonal pore is circular, and extends to the pyrites, with which the phragmocone is filled; it is about one fourth of the breadth of the shell in diameter. The septa are distant.

This unique and valuable specimen enriches the cabinet of Mr. Sowerby, whose kindness in conceding the use of it for description I beg to acknowledge. It was found in the clay removed in constructing the archway at Highway.

The length is ·5 in.; the breadth at the upper extremity is ·25 in., and across the umbonal pore ·15 in.

## Order—*TETRABRANCHIATA. Owen.*

### *Family*—Nautilidæ.

According to Von Buch, the division, which has been made of the tetrabranchiate Cephalopods into the two great families *Nautilidæ* and *Ammonitidæ*, has been determined solely by the position of the siphuncle, which, in the latter family, is invariably placed on the *ventral* margins of the septa; while, among the *Nautilidæ*, it is placed at or near the *centre* of the discs of the septa. Other differences exist in the form and condition of the septa, which, among the *Nautilidæ*, are characterised by simple curvatures or undulations, and by having their margins entire; while, among the *Ammonitidæ*, the septa present a series of lobes or sinuous flexures, the margins of which are foliated.

A third group, however, exists, in which the siphuncle is placed on the *dorsal* margin, and the septa are distinguished by angular or rounded lateral lobes, but their margins are perfectly simple. This group, for the typical forms of which Count Münster established the genus *Clymenia*, has been hitherto generally associated with the Nautilidæ; but I propose to separate it as a distinct family, under the name *Clymenidæ*.

The *Nautilidæ* will then be confined to those genera in which the siphuncle is *central* or *excentric*, that is, placed at the centre of the disc of the septum, or between that and the margin; or, more strictly, to those in which it is not placed either on the ventral or on the dorsal margin.

As thus restricted, the Nautilidæ will consist of the following genera: *Nautilus*, *Planulites*, Lam., *Gyroceras*, *Lituitus*, *Campulites*, Desh. (Cyrtoceras, Gold.), *Phragmoceras*, *Orthoceras*, *Actinoceras*, *Koleoceras*, Portl., and *Poterioceras*, M'Coy (Gomphoceras, Sow.)

Of these genera, the Nautilus only has been found above the secondary formations.

The generic distinctions are taken chiefly from the position of the siphuncle, and the mode of convolution or the form of the shell.

### *Genus* 4. NAUTILUS—*Gualtieri*, *Linnæus*.

OCEANUS; BISIPHITES. *De Mont.*
OMPHALIA. *De Haan.*

Gen. desc. Animal; *body* oblong, posteriorly rounded, and terminating in a slender membranaceous tube; *head* above, with an ambulatory disc; *arms*, nineteen (?) on each side;* *labial tentaculiferous appendages*, four, arranged round the mouth; *tentacula* of three kinds, viz. *ophthalmic*, lamellose, two on each side; *brachial*, annulose, twenty on each side; *labial*, annulose, twenty-four on each side; the whole body contained in the last chamber of a large multilocular shell, and affixed by two lateral muscles.

Shell; discoidal, spiral, multilocular, with simple walls; the whorls contiguous, the last covering the others; septa transverse, concave without, perforated in the disc, margins quite simple.

*Animal* corpore *oblongo, postice rotundato, tubo gracili membranaceo terminato;* capite *supra disco ambulatorio;* brachiis *utrinque novemdecem;* (?) appendicibus labialibus tentaculiferis, *quatuor, circum os dispositis;* tentaculis *trium generum, quorum*, ophthalmicis, *lamellosis, utrinque duobus;* brachialibus, *annulosis, utrinque viginti;* labialibus, *annulosis utrinque viginti quatuor; toto corpore in camerâ ultimâ testæ magnæ multilocularis recondito et musculis duobus lateralibus affixo.*

*Testâ discoideâ, spirali, polythalamiâ, parietibus simplicibus; anfractibus contiguis, ultimo alios obtegente; septis transversis, extûs concavis, disco perforatis, marginibus simplicibus.*

The Nautilus is the only genus of the Cephalopoda which, appearing among the earliest forms of animal life, has survived the various changes which the earth has undergone. The large family, of which it forms the type, flourished during the Palæozoic epoch, and the Nautilus itself apparently attained its fullest development during the deposition of the carboniferous series, at which period nearly fifty species existed. Gradually diminishing in numbers, the genus passed through the Mesozoic epoch into the tertiary era, which it has also survived; and though reduced to four species, which have not any fossil representative,† it still exists in the tropical seas.

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* M. Valenciennes states the number to be seventeen.

† The identification of the species in the Miocene formations of Turin cannot be relied upon.

The Nautilus appears to have been known to Aristotle, of whose shell-bearing polypi, the second is considered to be the Nautilus Pompilius; the first species, the true Nautilus of the ancients, and to which Gualtieri gave the name *Cymbium*, is the *Argonauta* of Linnæus. Although the shell of the recent Nautilus has long been commonly known, little information existed as to the animal, beyond that given by Aristotle, until a comparatively recent period. At the beginning of the last century the Dutch naturalist Rumph drew the attention of zoologists to the animal of the Nautilus; a description of which, illustrated by figures, he gave in his work 'D Amboinische Rariteitkamer.' From Rumph's description, which, however imperfect, was more intelligible than his drawing, De Montfort gave an imaginary representation of the animal, wide of the truth, but which was adopted by Shaw. After the time of Rumphius not any additional information was procured until the arrival in England, in 1831, of a specimen of the *Nautilus Pompilius*, taken by Mr. Bennett in Marachini Bay on the south-west side of the island of Erramonga, one of the New Hebrides. It is true that in the preceding year MM. Quoy and Gaimard had published, in the 'Annales des Sciences Naturelles,' an account of a portion of some unknown molluscous animal, which they supposed to be the *Nautilus Pompilius*, found near the island of Celebes; but the remains were too imperfect for satisfactory description, and, in fact, they have generally been attributed to a Heteropodous Mollusc, either Carinaria or Pterotrachea. The specimen brought over by Mr. Bennett was placed in the hands of Professor Owen, who in 1832 published his Memoir before referred to with minute anatomical descriptions and illustrations. In 1839 M. Valenciennes published an account entitled 'Nouvelles Recherches sur le Nautile flambé,' taken from an individual transmitted to the Museum of Natural History at Paris. These two works afford ample information as to the animal, but it is unnecessary to enter into the details, a brief outline, sufficient for the present purpose, having already been given. Of the soft parts of the animals which inhabited the fossil shells, no trace has been found to assist the Palæontologist, who must, therefore rely wholly on the calcareous remains for specific distinctions. As regards the tertiary species, these distinctions appear to be tolerably well defined; and but little difficulty will be found in the determination of the species.

The shell is smooth, spiral, and symmetrical; suborbicular, or somewhat depressed, and more or less round on the ventral aspect; the margins of the aperture are smooth and simple; the whorls are contiguous, and convoluted in a vertical plane, the last being the largest and concealing the rest, by which character it is distinguished from *Planulites*, the whorls of which are exposed. In some species the umbilicus is open; but more generally it is closed, as in the adult specimens of the recent *N. Pompilius*, by a deposition of nacreous or calcareous matter. The lines of growth are distinct, and in some species strongly marked, giving a somewhat striated appearance to the shell; and they are reflected backwards, in which respect they differ from those of the *Ammonitidæ*, which are bent forwards. The chambers are separated by transverse partitions, more or less undulated; and in one species, *N. Parkinsoni,* they are distinguished by lateral angular lobes, resembling those of *Aturia* (*Nautilus*) *zic-zac,* and the margins are invariably simple and entire. The discs of the septa are perforated at the centre, or at parts more or less distant from the margins, but never at the margin, by a calcareous siphuncle, variable in size and generally discontinuous, that is, extending more or less into the preceding chamber, but not into the preceding siphuncular aperture. The chambers themselves increase in size to the last, which is sufficiently large to contain the whole of the animal; but the ratio of increase is apparently uncertain, and is influenced probably by the growth of the animal, which would, of course, depend on the supply of food and other circumstances.

The fossil substances termed *Rhyncolites,* which occur so frequently in the older formations, and which are generally believed to be the mandibles of some of the Tetrabranchiate Cephalopods, with whose remains they are associated, have been found both in the Paris basin and in the tertiary formations in Belgium; but I believe that as yet they have not been found in the Eocene strata of England.

The specific characters in this genus are taken from the curvature of the septa, the general outward form of the shell, (which, in fact, determines the shape of the septum,) the position of the siphuncle and the condition of the umbilicus. With respect to the terms *dorsal* and *ventral,* it must be borne in mind that they are used in the following descriptions in a sense directly the reverse of that in which they have been generally applied. The Nautilus, in its normal position, rests upon, or creeps along the ground by means of, the free and expanded anterior portion of the mantle. In this position the back of the animal is against the penultimate whorl of the shell, and the ventral part is contained within the concavity of the dwelling-chamber. In the following descriptions, therefore, the term *dorsal* is used to designate the parts contiguous to the penultimate volution of the shell, and which have been generally, though incorrectly, described as ventral; and the term *ventral,* on the other hand, will be applied to those parts on which the belly of the animal rested, and which hitherto have usually been termed dorsal.

At present six species have been found in the tertiary strata of England, and they are confined to the older Eocene deposits. In the contemporaneous strata of the Paris basin two species occur, one of which is also found in Belgium; but not either of them has as yet been found in England; and four species have been described by Sismonda and Michelotti, as occurring in the Miocene formations in Piedmont. Two of these last species are referred by those authors to existing species; but the accuracy of the identification is questioned.

## No. 7. NAUTILUS CENTRALIS. *Sowerby*. Tab. III, fig. 1*a*—*c*.

NAUTILUS CENTRALIS. *J. Sow.* 1812. Min. Con. vol. i, p. 11, tab. 1, left-hand figure.
— AUSTRALIS (by error for CENTRALIS). *Defrance.* 1825. Dict. des Sc. Nat. vol. xxxiv, p. 297.
— CENTRALIS. *Wetherell.* 1836. Philos. Mag. and Journal, vol. ix, p. 465.
— BUCKLANDI. (?) *Michelotti.* 1840. Ind. rag. di alcuni Testacei de Cefal. foss. &c. Ann. delle Scien. del Regno Lomb.-Veneto, p. 4.
— CENTRALIS. *Morris.* 1843. Cat. Brit. Foss. p. 182.
— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 338.
— — *Sow.* 1849. Dixon's Geol. Hist. &c. pp. 110, 121, tab. 14, fig. 28.

*N. testá globosá, in aspectu ventrali rotundatá; aperturá semilunari; umbilicatá, umbilicis angustis, profundis; septis extûs concavis, simplicissimis, siphone centrali, minimo, continuo perforatis; lobis dorsalibus latis, haud reflexis.*

The N. centralis, in the simplicity of the septa and the central position of the siphuncle, nearly resembles the recent Nautili. It is a very ventricose, almost a globose shell, much rounded on the ventral aspect; the aperture is bluntly lunate, nearly semicircular, and is rather more than twice as wide as it is long; the open umbilicus is narrow and deep; the septa are concave outwardly, and simple, scarcely presenting any undulation or second curvature whatever; the dorsal lobes are broad, each being nearly one third of the width of the aperture, and they are bluntly rounded on their superior margins; the siphuncle is very small, central, or nearly so, and continuous. The lines of growth present broad undulations, and are strongly marked and decussated.

Michelotti has described a Nautilus from the Miocene formations of the Colle de Torino, in Piedmont, to which he has given the name *Bucklandi*. He quotes *N. centralis* of Sowerby by the name *N. australis* (an error into which he has fallen by relying on Defrance's quotation), and he considers his shell to be identical with it, and, oddly enough, associates with it *N. imperialis*. The specific description given by this author agrees tolerably well with that of the present species; but I have not myself had any opportunity of comparing the Piedmontese with the English shell; and as Michelotti does not mention his having compared the two, and he appears to have trusted implicitly to Defrance, the accuracy of the identification must for the present be considered as doubtful.

Mr. Wetherell, in his paper above quoted, gives this species and *Naut. regalis* as characteristic of the middle division of the three which he thinks might be made of the true London Clay. It occurs at Regent's Park, Chalk Farm, Hyde Park, Richmond, Sheppy, and Bognor; it is also found, though very rarely, at Bracklesham Bay.

The species does not appear to have attained a great size, the largest specimen not exceeding 3·7 in. in diameter, by 3·3 in. across. The figs. 1 and 2, Tab. III, are taken from specimens in the collection of Mr. Wetherell; fig. 3, from one in that of Mr. Sowerby. The form of the septum is shown by fig. 2, Tab. VIII.

No. 8. NAUTILUS REGALIS. *Sowerby*. Tab. IV.

NAUTILUS REGALIS. *J. Sow.* 1823. Min. Con. vol. iv, p. 77, pl. 355.
— — *Def.* 1825. Dict. des Sc. Nat. vol. xxxiv, p. 300.
— — *Weth.* 1836. Philos. Mag. and Journ. vol. ix, p. 465.
— — *Morris.* 1843. Cat. Brit. Foss. p. 183.
— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 338.
— — *Sow.* 1849. Dixon's Geol. Hist. &c. p. 120.

*N. Testâ lævigatâ, sub-ventricosâ, in aspectu ventrali compressâ, obscurè undulatâ; aperturâ obtusè-ellipticâ; umbilicis obtectis; septis simplicibus, concavis, utroque latere perparum undulatis, siphone sub-centrali perforatis; lobis dorsalibus brevibus, rotundatis, haud reflexis.*

The present species is distinguishable from the preceding by the closed umbilicus, and by its general form, which is less ventricose than that of *N. centralis.* It is a smooth shell, flattened on the sides, and bluntly rounded, and obscurely undulated on the ventral aspect. The aperture presents a subquadrate appearance. The umbilicus is closed by a thickening of the lip, assuming the appearance of a solid axis to the shell. The septa are nearly simple, presenting on each side slight undulations, and the short, rounded dorsal lobes are deeply concave, and not reflected. In the young shell the septum is characterised by a conical depression placed on the dorsal margin close to the preceding whorl; as the shell enlarges this gradually decreases in size and depth, and ultimately disappears. It was of course moulded on a corresponding protuberance on the animal, probably an enlargement of the epithelial cincture. In some species the cavity is very deep. It was on this character that De Montfort, mistaking the depression for the mouth of a second siphuncle, founded his genus Bisiphites. The siphuncle is small and excentric. The lines of growth, like those of the preceding species, are decussated, and reflected backwards in broad undulations.

The Nautilus regalis attained a large size. The specimen figured, for the use of which I am indebted to Mr. Dixon, measures 9·5 in. in diameter, by 5 in. across. The species occurs at Islington, Regent's Park, Chalk Farm, Hyde Park, and at Bognor. It appears to have been one of the most common of the English Eocene Nautili. The septum is represented at Tab. VIII, fig. 5.

No. 9. NAUTILUS URBANUS. *Sowerby*. Tab. III, fig. 2 *a*—*b*.

NAUTILUS URBANUS. *J. D. C. Sowerby.* 1843. Min. Con. vol. vii, p. 36, pl. 628.
— — *Morris.* 1843. Cat. Brit. Foss. p. 183.
— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 338.

*N. Testâ discoideâ, in aspectu ventrali rotundatâ, et obscurè undulatâ; umbilicatâ; aperturâ subquadratâ, elongatâ; septis oblongis, concavis, in utroque latere leniter undulatis et siphone excentrico perforatis; lobis dorsalibus perbrevibus, obliquè truncatis, haud reflexis.*

A flat discoidal shell, rounded on the ventral aspect, and presenting obscure undulations similar to those which characterise *N. regalis*. The aperture has an elongated, subquadrate shape; the umbilicus is narrow; the septa concave, and slightly undulated; they present on each side, in a line with the preceding whorl, a slight depression, which appears to be the first indication of the lateral lobes so fully developed in the *N. Parkinsoni;* the siphuncle is excentric approaching the dorsal margin; the dorsal lobes are short, very slightly concave, obliquely truncated, and not recurved. The lines of growth are prominent, and decussated more strongly than those of the two preceding species, and their undulations are broad and shallow.

The Nautilus urbanus is distinguishable from *N. centralis* by its flatness, and the greater length of its aperture; and from *N. regalis* by its open umbilicus, the truncated extremities of the dorsal lobes of the septa, and its discoidal shape. It is a very rare shell. The figures 2*a*, 2*b*, Tab, III, are taken from the shells drawn in 'Mineral Conchology,' the only specimens with which I am acquainted. The larger one, belonging to Mr. Sowerby, was found in excavating St. Katharine's Docks, near the Tower of London; the smaller one forms part of Mr. Bowerbank's collection, and was obtained from Sheppy.

The size of the larger individual figured is 7·4 in. in diameter, by 3·4 in. Fig. 4, Tab. VIII, represents the septum.

### No. 10. NAUTILUS IMPERIALIS. *Sowerby*. Tab. V.

NAUTILUS IMPERIALIS. *J. Sow.* 1812. Min. Con. vol. i, p. 9, tab. 1, upper and right-hand figures.
— — *Defrance.* 1825. Dict. des Sci. Nat., tome xxxiv, p. 297.
— — *Wether.* 1836. Philos. Mag. and Journ. vol. ix, p. 465.
— BUCKLANDI. *Michelotti.* 1840. Indice ragionato, &c. p. 4.
— IMPERIALIS. *Morris.* 1843. Cat. Brit. Foss. p. 182.
— — *Pictet.* 1845. Traité élément. de Paléont. vol. ii, p. 338.
— — *Sowerby.* 1849. Dixon's Geol. Hist. &c. pp. 110, 120.

*N. Testâ sphæroidale; umbilicatâ, umbilicis angustis, profundis; aperturâ subellipticâ, semilunari; septis undatis, siphone mediocri dorso-excentrali perforatis; lobis dorsalibus latis et perparum reflexis.*

This species is easily distinguished from the *N. centralis* by the excentric position of the siphuncle, as well as by the broad and reflected extremities of the dorsal lobes, which form, as it were, an axis to the shell. Its orbicular form, the lunate shape of the septa, and the recurved dorsal lobes, distinguish it as clearly from *N. regalis* and *N. urbanus.*

The *Nautilus imperialis* is a somewhat globose shell, rather narrow on the ventral aspect, whence the aperture assumes a sub-elliptical form; the umbilicus is small and deep. It is well displayed in the large figure, Tab. V, taken from a specimen in Mr. Bowerbank's collection, but generally, it is found open only in young shells; in the larger specimens it is usually filled with pyrites or indurated clay. The septa are deeply concave, and present a gentle undulation on each side; the dorsal lobes are very broad, inflected towards the axis, and obliquely truncated on the inferior margins. The siphuncle is moderately large, and excentric, being placed on the dorsal side of the centre of the disc. It appears to vary in its position, gradually becoming more distant from the dorsal margin as the shell enlarges. The lines of growth are reflected backwards in a deep narrow wave, and in the specimens I have seen are not decussated as in the three preceding species.

In the shell described by Michelotti under the name *N. Bucklandi*, and with which he has associated the present species, the siphuncle is central; and that character is, in fact, the reason assigned by him for considering his shell to be identical with *N. centralis* as well as with *N. imperialis*. Whether the alleged identification of *N. Bucklandi* with *N. centralis* be correct or not, it is obvious that the Piedmontese shell cannot be referred to the present species. Defrance states that the *N. imperialis* did not appear to differ from *N. centralis*, and Michelotti has, in fact, relied implicitly on that author; he has even copied the mistake made in quoting *N. centralis* as *N. australis*.

The *N. imperialis* attained a very large size; a specimen from Sheppy in the Museum of the Geological Society measures 12 inches by 8·75 in. across. It appears to have been widely spread, being found at Highgate, Hornsey, Brentford, Sheppy, Cuffell near Basingstoke, Clewett's Green, Newnham, Bognor, and Bracklesham. The form of the septum is shown in Tab. VIII, fig. 1.

### No. 11. NAUTILUS SOWERBYI. *Wetherell.* Tab. VI.

NAUTILUS SOWERBYI. *Weth.* 1836. Phil. Mag. and Journ. vol. ix, p. 466.
— — *Morris.* 1843. Cat. Brit. Foss. p. 183.
— — *Sow.* 1843. Min. Con. vol. vii, p. 35, pl. 627, fig. 1-3.
— — *Sowerby.* 1849. Dixon's Geol. Hist. &c. p. 121, tab. 14, fig. 28.

*N. Testá lævigatá, lenticulari, ventrali aspectu angustè rotundatá; umbilicatá, aperturá sub-triangulari; septis profundè concavis; siphone continuo, prope margines dorsales posito, perforatis; utroque latere latè undulosis et sublobatis; lobis dorsalibus elongatis, valdè reflexis, obliquè truncatis.*

The *N. Sowerbyi* is an exceedingly well-marked species. It is a smooth, discoidal, convex or rather lenticular shell, somewhat resembling in shape the Dax form of

*Aturia* (*Nautilus*) *zic-zac*, but it is narrower towards the margin, which circumstance gives a triangular form to the aperture. The septa (Tab. VIII, fig. 3) are very concave, and present on each side a broad undulation, with a deep sinus-like depression caused by a lateral lobe, more developed in this species than in *N. urbanus*, although not attaining the size and importance of that which distinguishes *N. Parkinsoni*.

The dorsal lobes are much recurved and obliquely truncated; the siphuncle is moderately large, placed very near to the dorsal margin, and continuous. The striæ of growth towards the middle are suddenly bent backwards in deep undulations.

This species, which attained a size of 10 inches in diameter by 4·2 in. across, was first obtained by Mr. Wetherell from the tunnel made at Chalk Farm for the Birmingham Railroad. It has also been found in the cuttings now in progress between Whetstone and Barnet for the Direct Northern Railroad, and it occurs at Sheppy and at Bognor, where it is very common.

### No. 12. NAUTILUS PARKINSONI. *F. E. Edwards*. Tab. VII.

NAUTILITE. *Parkinson*. 1811. Organic Remains, p. 105, pl. 7, fig. 15.

*N. testâ discoideâ, aperturâ elongato-ellipticâ, parietibus convexis; umbilicis* (?)*; septis extûs concavis, in utroque latere angulariter lobatis, siphone, prope margines dorsales posito perforatis; lobis lateralibus brevibus, subtriangularibus, mucronatis; lobis dorsalibus latis, perparum concavis, ad extremitates attenuatis, reflexis.*

Parkinson, in his work above cited, described the remains of a Nautilus, purchased by him at the sale of Dr. Menish's collection. These remains, which consist of the casts of three chambers, afterwards came into the possession of Mr. Sowerby, who has placed them at my service. Parkinson was ignorant of the locality whence they came; but from their mineralogical character, the matrix being, in fact, the substance known as cement-stone, it was supposed that they were found at Harwich. Lately the Rev. Thomas Image, of Whipstead, near Bury St. Edmunds, has forwarded to me for examination similar remains, unquestionably obtained at Harwich, and consisting of the casts of two chambers, rather smaller than those in Parkinson's specimen, and in a matrix precisely similar. The question, therefore, as to the locality of Parkinson's specimen is set at rest.

These remains are particularly interesting, from the circumstance that in them the angularly-lobed septum which characterises *Aturia* (*Nautilus*) *zic-zac*, and in that shell is accompanied by a strictly dorsal siphuncle, is associated with one which, although very excentric, is still so truly discal, as to prevent the shell being removed from the present genus. The form of the septum is a good specific character, but it cannot be relied upon as a generic distinction. The *Nautilus Parkinsoni*, therefore, although in general appearance it closely resembles *Aturia*, must, in fact, from the position of the siphuncle be considered as an aberrant *Nautilus*, connecting that genus with *Aturia*, and leading through the *Clymenidæ* into *Goniatites* and *Ammonites*.

The *N. Parkinsoni* is a discoidal shell, with regular convex sides, and an elongated elliptical aperture. The specimens do not exhibit the condition of the umbilicus. The septa are outwardly moderately concave, with angular lobes on each side; the dorsal lobes are very broad, somewhat concave, rounded at the extremities, and reflected, although not much, towards the axis; the lateral lobes are short, wide at the upper extremities, and they taper rather suddenly; their inferior margins are nearly straight, but the superior margins present a deep sinus. The siphuncle is moderately large, and is placed on the dorsal part of the septal disc, half way between the centre and the margin. So far as the general character can be ascertained, the siphuncle does not appear to differ from that of *Nautilus*, and certainly does not present any analogy with the wide trumpet-mouthed funnel which distinguishes *Aturia*.

This species appears to have attained a greater size than any other of the tertiary Nautili; the largest chamber in Parkinson's specimen measures seven inches in breadth, and nine inches in length; and this chamber was not the last, and consequently not the largest.

## *Family*—CLYMENIDÆ.

AGANIDÆ. *Pictet, Deshayes, D'Orbigny.*

Adopting the opinion of Von Buch, that the position of the siphuncle is the principal, if not the only, character by which the Tetrabranchiate Cephalopods can be divided into families, it becomes impossible to include those genera in which the siphuncle is placed on the *dorsal* margin, either among the Nautilidæ, in which it is *central* or *excentric*, or among the Ammonitidæ, in which it is placed on the *ventral* margin. The only genera at present known to possess a strictly dorsal siphuncle, are *Clymenia*, Munst. (*Endosiphonites*, Ansted), and *Aturia*, a genus proposed by Bronn for the *Nautilus Aturi*, Basterot (*N. zic-zac*, Sow.) In fact, these genera have already been considered by MM. d'Orbigny, Deshayes, and others, to form a subdivision of the Nautilidæ, to which those authors have applied the name Aganidæ, founded on a genus proposed by De Montfort for a shell from the mountain limestone. This shell, however, possessed a ventral siphuncle, and belonged to the genus Goniatites.* The name *Aganidæ*, therefore, cannot with propriety be retained as a family name for genera characterised by a *dorsal* siphuncle; and I have adopted, in lieu of it, the name *Clymenidæ*, founded on Munster's genus.

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* The shell figured and described by De Montfort as *Aganides* is, I believe, the *Goniatites sphæricus* of Sowerby.

The septa in the *Clymenidæ* are distinguished by lateral rounded or angular lobes; but the angular form is not peculiar to the family; since, as we have already seen, it is found in *Nautilus Parkinsoni*, a species which, possessing an excentric siphuncle, must be considered as merely an aberrant form of Nautilus; and the separation of the *Clymenidæ* will depend entirely on the siphuncle being placed on the dorsal margin.

The two genera which belong to this family are distinguished chiefly by the mode of involution of the shell; the whorls in *Clymenia* being exposed, while in *Aturia* the last whorl conceals the rest; they therefore bear to each other the same relation which *Planulites* bears to the true *Nautilus*.

## *Genus* 5th. ATURIA.* *Bronn*, 1837.

Gen. desc. *A. testâ discoideâ vel subventricosâ, spirali, multiloculari, parietibus simplicibus; anfractibus contiguis, ultimo alios obtegente; umbilicis clausis; septis transversis, numerosis, extûs concavis, utroque latere angulariter lobatis et parte dorsali, magnâ siphone infundibuliformi, marginibus positâ, retro prolongatis; marginibus simplicibus.*

Shell discoidal or subventricose, spiral, multilocular, sides simple; whorls contiguous, the last concealing the others; the umbilicus closed; septa transverse, numerous, concave outwardly, with an angular lobe on each side, and having the dorsal part prolonged backwards, forming a large, marginal, funnel-shaped siphon; margins of the septa entire.

The angularly-lobed septum which distinguishes *Nautilus Parkinsoni* also forms a prominent character in the well-known Highgate fossil, *Naut. zic-zac*, figured and described by Mr. Sowerby in the first volume of the 'Mineral Conchology.' Bronn, in his description of the Dax shell *Nautilus Aturi* (Bast.), which he considered to be distinct from *N. zic zac*, suggested the propriety of forming a sub-genus, to be called *Aturia*, for the reception of those tertiary Nautili in which, according to the subgeneric description given by him, "the siphon is sub-ventral (i. e. sub-dorsal), and the septa have a deep, narrow, lancet-shaped flap on each side." The siphuncle, however, in the Dax shell, on which the genus is founded, is, in fact, strictly *marginal;* it is, as Bronn himself describes it, a prolongation backwards of the dorsal part of the septum, in the shape of a wide-mouthed funnel, extending quite across the preceding chamber, and deeply into the mouth of the preceding funnel. As this funnel-shaped siphon decreases in diameter, the dorsal paries gradually recedes from the margin, and the intervening space is filled up with a calcareous deposit. The siphuncle, therefore, will in some parts of its extent appear to be sub-marginal only: whereas the mouth of the siphuncle, by which only the position can be determined, is perfectly marginal. The *Nautilus Aturi*, which I consider to be identical with *Nautilus zic-zac*, is the type of Bronn's genus, and I therefore retain the name proposed by that author, although I do not assent to the accuracy of his generic description.

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* Etym. Aturrus *vel* Aturus—the River Adour.

The genus *Clymenia*, proposed by Count Munster for certain Nautiliform remains occurring in the transition limestones of Fichtelgebirge, presents nearly the same characters as those assigned by me to *Aturia;* except that in *Clymenia* the whorls are exposed, and the siphuncle is described as narrow; whereas in *Aturia* the last whorl conceals the others, and the siphuncle, at least in *A. zic-zac*, the typical species, is of great size.

The genus appears to have been confined to the tertiary epoch, and it is widely diffused. It occurs in the Eocene formations of England, France, Belgium, and Germany; in the Miocene deposits in the basins of the Gironde, in Italy, and in Malta. It is also found in the Eocene formation in Clarke county, Alabama, (U. S.), and Conrad* mentions a cast from the contemporaneous formation near Long Branch, New Jersey, resembling Nautilus (Aturia) zic-zac, but more compressed, and which he has referred to De Montfort's genus *Pelagus*, and has named *P. Vanuxemi*. De Montfort's *Pelagus*, however, is described as having "cloisons lobées, *persillées*, *dentelées*, &c." The position of the siphuncle is not mentioned in De Montfort's text; but in the figure he has given it is placed on the ventral margin. The shell, therefore, on which the genus Pelagus is founded is an Ammonite, and the species constituting the present group cannot be associated with it.

### No. 13. ATURIA ZIC-ZAC. *Bronn.* Tab. IX, fig. 1*a*—*h*.

Var. *a*. NAUTILUS ZIC-ZAC. *Sow.* 1812. Min. Con. vol. i, p. 9, pl. 1, fig. 3.
AMMONITES WAPPERI. *Van Mons.* 1833. L'Institut. 1833, p. 272.
— — — 1834. Bull. de l'Acad. de Brux. tome i, No. 17, pp. 113, 118.
NAUTILUS DESHAYESII. *De Koninck.* 1834. Notice sur un Moule pyriteux du Naut. de Desh.; Bull. Soc. Géol. de France, t. iv, p. 437.
— — *Nyst.* 1835. Rech. sur les Coq. foss. de la Prov. d'Anvers, p. 35, No. 52.
— — *De Koninck.* 1837. Desc. des Coq. foss. de l'Argile de Basele, p. 1.
— ATURI. *Bronn.* 1837. Leth. Geog. vol. ii, p. 1123, pl. 42, fig. 17*a*—*c*.
— ZIC-ZAC. *Desh.* 1837. Desc. des Coq. foss. des Env. de Paris, vol. ii, p. 765, pl. 100, figs. 2, 3.
CLYMENIA ZIC-ZAC. *Michelotti.* 1840. Annal. Scient. reg. Lomb. Venet. p. 6.

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* Conrad's "Observations on the Eocene formation, and description of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi," published in the Journal of the Academy of Natural Science of Philadelphia.

NAUTILUS ZIC-ZAC. *Nyst.* 1843. Bull. Soc. Géol. de France, vol. xiv, p. 452.
— — — 1843. Desc. des Coq. foss. &c. des Terr. tert. de la Belgique, p. 644, pl. 46, fig. 4.
— — *Morris.* 1843. Cat. Brit. Foss. p. 183.
AGANIDES DESHAYESII. *Sismonda.* 1847. Method. Anim. invert. Pedemontii Foss. p. 57.
— ZIG-ZAG. *Pictet.* 1845. Traité élément. de Paléont. Vol. ii, p. 341.
NAUTILUS (CLYMENIA ?) ZIC-ZAC. *Sow.* 1849. Dixon's Geol. Hist. &c. p. 109, pl. 8, fig. 19.
Var. β. NAUTILE DE DAX. *De Montf.* 1802. Buffon de Sonnini Moll. vol. iv, pp. 240, 252, pl. 46, fig. 1.
NAUTILUS POMPILIUS. *Lam.* Ann. du Mus. vol. v, p. 181.
— — — 1822. An. sans Vert. vol. xvi, p. 634.
— DESHAYESII. *Defr.* 1825. Dict. de l'Hist. Nat. vol. xxxiv, p. 200.
— ATURI. *Bast.* 1825. Desc. des Coq. foss. des Env. de Bordeaux, p. 17.
ORBULITES ZIC-ZAC. *De Blainv.* 1825. Man. de Malac. p. 387.
NAUTILUS (AGANIDES) ATURI. *D'Orb.* 1825. Tab. méthod. de la Classe des Céph. p. 71.
— SYPHO. *Buckl.* 1836. Bridgw. Treat. vol. i, p. 357, pl. 46, figs. 1-4.
— — *Grateloup.* 1838. Cat. des An. vert. et invert foss. du Basin de la Gironde, p. 28.
AGANIDES ATURI. *Pictet.* 1845. Traité élément. de Paléont. Vol. ii, p. 341.

*A. Testá ventricosá, lævigatá; umbilicis clausis; septis concavis; lobis lateralibus angustis, acutis; dorsalibus valdè recurvis; siphone magno, continuo, buccinæformi.*

Var. β. *Testá compressá, sub-discoideá; septis profundè concavis, lobis dorsalibus angustioribus.*

Shell ventricose, smooth; umbilicus closed; septa concave; lateral lobes narrow, pointed; dorsal lobes much curved; siphuncle large, continuous, trumpet-shaped.

There are scarcely any tertiary remains which have excited so much attention as the present; not merely because the species is widely diffused, but because it presents an intermediate form between the Nautili and the Ammonites; and few fossils have been referred to more genera, or have been distinguished by a greater number of specific names.

The *Aturia zic-zac* was first described by Mr. Sowerby, sen., as Nautilus zic-zac, from a specimen which was found on forming the tunnel of the Highgate Archway. Several years afterwards M. Defrance described a specimen from the Paris basin, and pointed out the differences which, in his opinion, rendered it difficult to refer the species to the genus *Nautilus.* M. Defrance considered the fossil described by him as distinct from the *N. zic-zac,* and gave to it the specific name *Deshayesii.* Subsequently Basterot described the well-known Dax fossil, which he named *Naut. Aturi,* and with which he considered the *Naut. zic-zac* to be identical. M. d'Orbigny and Sig. Sismonda, not regarding the dorsal position of the siphuncle, but relying on the angular lobes which characterise the septa, have referred the shell in question to De Montfort's *Aganides,* a genus which, as has been before stated, was founded on a *Goniatite* from the mountain limestone. Michellotti, on the other hand, has considered the present remains as forming part of Munster's *Clymenia*, a genus distinguished by its having the whorls exposed.

The Aturia zic-zac is a smooth, involute shell, more or less ventricose or depressed; the septa are outwardly deeply concave; and, owing to the regular curve in which the dorsal lobes are reflected towards the axis of the shell, they present, when viewed sideways, some resemblance to the letter S; the lateral lobes are more or less narrow, and taper rather suddenly towards the inferior extremity, which extends nearly to the preceding septum; but they are without the sinus which characterises the lateral lobes of *Naut. Parkinsoni*. The English shells are generally either casts in, or filled with pyrites, and it is difficult to ascertain the character of the siphuncle from them; but in the Dax shells, in which the calcareous siphon is frequently well displayed, it presents a structure widely different from that of the Nautilus.* The dorso-marginal part of the septum, as I have before observed, is prolonged backwards in the form of a wide trumpet-mouthed funnel, which extends not only into the mouth of the funnel formed by the preceding septum, but along the preceding siphuncle almost to the floor of the third preceding chamber (see Tab. IX, fig. 2*a*). The calcareous siphuncle, therefore, is, in fact, a continuous tube of considerable thickness, composed of portions of two distinct tubes; and within this is contained a soft, friable, calcareous sheath, which commences near the extremity of the funnel, where it touches the preceding funnel, and extends to the end of the preceding funnel, to the interior surface of which it forms a sheath. Although, owing to the thickness of the walls and the presence of the calcareous sheath, the actual tube within which the membranous siphuncle was contained is not so capacious as might be expected from its external appearance, it is yet considerably larger than that of any of the tertiary Nautili; and indeed it is of such size and importance as fully to justify the name *Sypho*, which Grateloup has given to the Dax shell. The siphuncle in the English specimens, so far as its character can be ascertained, appears to correspond exactly with that of the Dax shells.

Great diversity of opinion has existed, and, in fact, still exists, as to the identity of the Dax shell with the *Naut. zic-zac* of Sowerby. The differences which have been relied on for the separation of the two appear to me to result from the more compressed form of the Dax shells; the specimen figured by Mr. Sowerby, although described as "flattish," being ventricose, and the outline of one of the septa drawn below the shell conveying the idea of greater fulness than in fact characterises the fossil. M. Deshayes, who compared the Dax shells with specimens as well from the Paris basin as from Belgian and English localities, expressed an opinion that the differences were sufficient to form, if not two species, at least two well-marked varieties. I have not myself had an opportunity of examining any French or Belgian specimens; but, through the kindness of Mr. Sowerby, Mr. Bowerbank, and Mr. Wetherell, who have afforded me the use of their specimens, I have before me a series of shells from Sheppy and the neighbourhood of London, including the identical specimen figured by Mr. Sowerby. Confining myself to external characters only, two distinct forms occur in this series, the differences in which, although they may require a separation into varieties, are not sufficient, in my opinion, for specific distinctions.

In the first variety, which is the true Naut. zic-zac, figured in 'Mineral Conchology,' and which I have therefore taken for the typical form, the shell is ventricose, the greatest width being little less than half the diameter; it is moderately round on the ventral aspect, and the aperture is a somewhat elongated ellipsis. In the other variety (β) the shell is more compressed, almost discoidal; and consequently it is narrower on the ventral aspect; the dorsal lobes are not so broad, and the aperture is of a more elongated oval form.

The French, Belgian, and German shells correspond apparently with the first, the typical form, and the Dax shells agree closely with the second variety. Michellotti has used for the Piedmontese specimens the specific description given by M. Deshayes; but he adds, that "they present some trifling differences from the Paris specimens, as do the latter from the London and Bordeaux shells." As, however, the Piedmontese shells are described as "ventricose," they must for the present be referred to the typical form, although we should naturally expect to find the Dax type continued in the Miocene formations of the Colle de Torino.

The Aturia zic-zac also occurs in the Miocene deposits in Malta, and the specimens which I have seen from that locality present the depressed form of the Dax shells, with which they agree in other respects.

Mr. Sowerby possesses a series of casts from the Eocene formation in Clarke County, Alabama, of a species which approaches very near to the typical *Aturia zic-zac;* the chief distinction appears to be in the form of the lateral lobes, which in the American shell extend quite to the margin of the preceding septa, and have their extremities inflected towards the axis, and present the deep sinus which characterises the lateral lobes of *Naut. Parkinsoni*. The siphuncle is very large, and corresponds with that of *A. zic-zac*. Conrad describes his *Pelagus Vanuxemi* as more compressed than the latter shell, and he adds that "the angles of the septa appear to be in contact near the periphery." This appearance, which is attributable to the length of the lateral lobes, and is represented in the figure given by Conrad by a continuous line running parallel with the periphery of the shell, is also found in the Alabama specimens, of which Conrad's shell is possibly only a compressed variety.

The typical form, which is represented at Tab. IX, fig. 1*a*, 1*b*, drawn from the original specimen figured in 'Mineral Conchology,' for the use of which I am indebted to Mr. Sowerby, is found at Highgate, Sheppy, and Bracklesham Bay. The variety β, which corresponds with the Dax shells, was obtained from the railroad cutting at Chalk Farm, and from the well sunk for the use of the Orphan School, at Haverstock Hill, near Hampstead. The specimen figured (Tab. IX, fig. 1*g*, 1*h*,) is from the former locality; it is the one drawn by Mr. Charlesworth in the 'Magazine of Natural History,' vol. i, (new series,) p. 533, and forms part of Mr. Wetherell's valuable collection of fossils from Highgate and the neighbourhood.

The English shells are apparently young; they are much smaller than the Dax specimens, the largest I have seen cannot have exceeded 1·6 in. in diameter.

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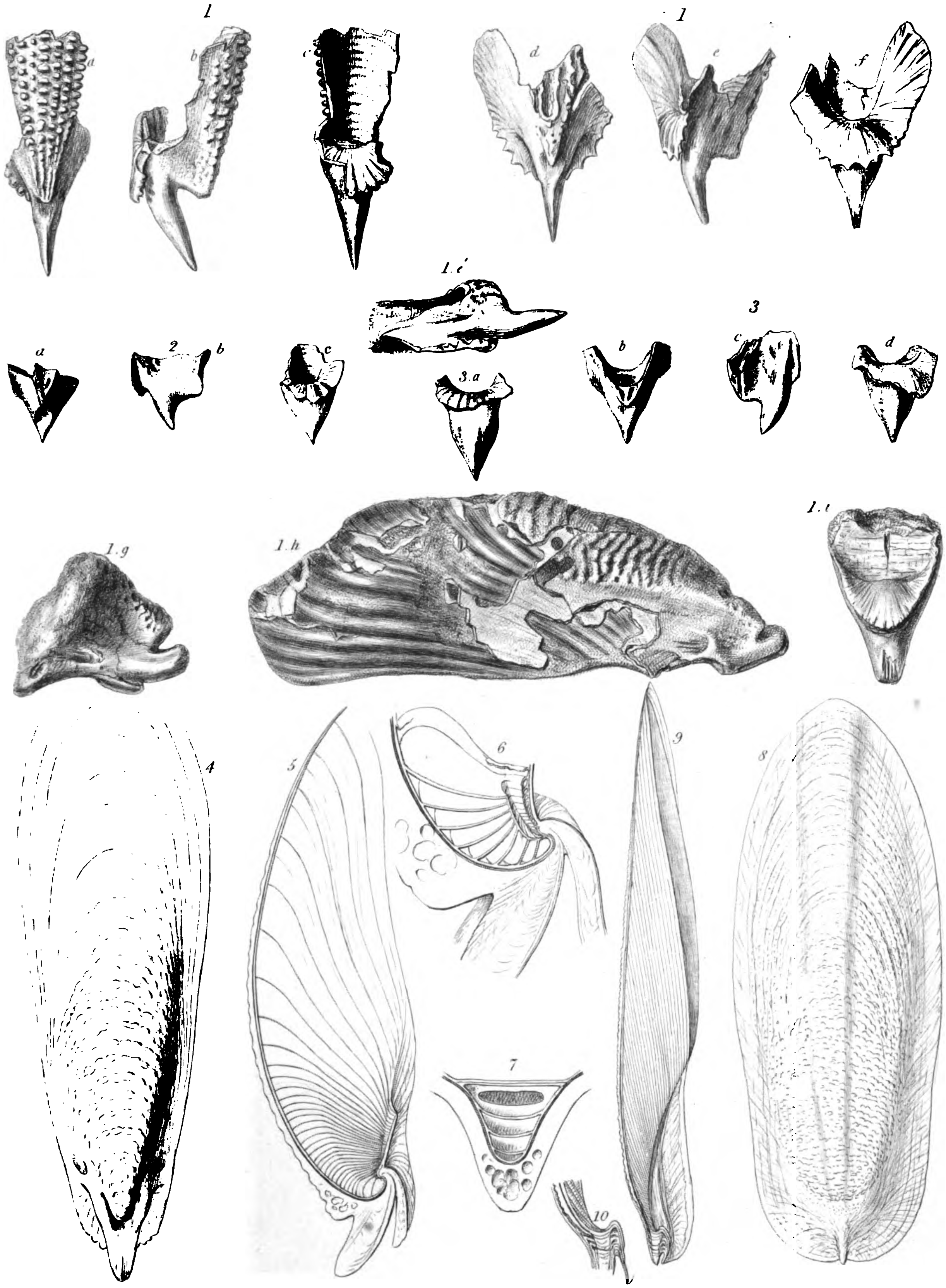
## TAB. I.

Fig.

1. Belosepia Sepioidea, *p.* 29.
    - 1*a*—*c*. Var. B. longirostris.
        - *a*. Dorsal aspect.
        - *b*. Side view.
        - *c*. Ventral aspect.
    - 1*d*—*f*. Var. B. longispina.
        - *d*. Dorsal aspect.
        - *e*, *e′*. Side views.
        - *f*. Ventral aspect.
    - 1*g*—*i*. Var. B. Blainvillii.
        - *g*. Side view.
        - *h*. Do. of a cast of the Belosepion (B. Sepioidea).
        - *i*. Ventral aspect.
2. Belosepia brevispina, *p.* 32.
    - *a*. Dorsal aspect.
    - *b*. Side view.
    - *c*. Ventral aspect.
3. Belosepia Cuvieri, *p.* 31.
    - *a*, *d*. Ventral aspect.
    - *b*. Dorsal aspect.
    - *c*. Side view.
4. Dorsal aspect of the Belosepion (B. Sepioidea).
5. Longitudinal section of ditto.
6. Enlarged view of the terminal cavity and rostrum in the same section.
7. Enlarged view of an obliquely transverse section of the terminal cavity.
8. Dorsal aspect of the sepion (Sepia officinalis).
9. Longitudinal section of ditto.
10. Enlarged view of section of the rostrum of ditto.

Tab. 1.



J.De C.S.

## TAB. II.

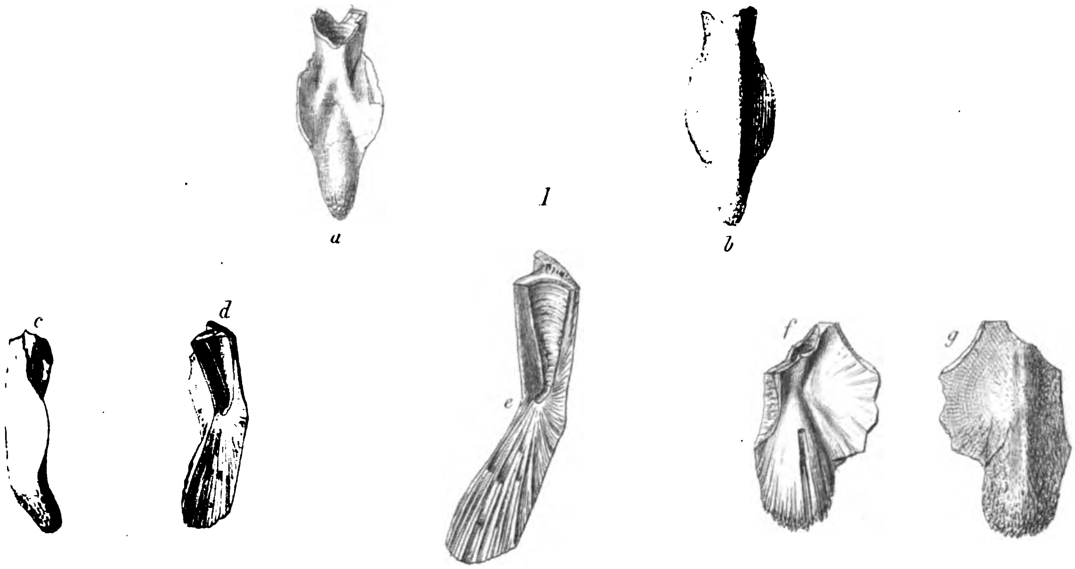
1*a*—*g*. Beloptera Belemnitoidea, *p*. 36.
- *a*. Ventral aspect.
- *b*. Dorsal do.
- *c*. Side view.
- *d*. Longitudinal section.
- *e*. Magnified view of do.
- *f*. Ventral aspect of variety.
- *g*. Dorsal aspect of do.

2*a*—*e*. Beloptera Levesquei, *p*. 37.
- *a*. Ventral aspect } of a young specimen.
- *b*. Side view } of a young specimen.
- *c*. Dorsal aspect } of a young specimen.
- *d*. Side view of an adult specimen.
- *e*. Ventral aspect of ditto.

3*a*—*e*. Belemnosis plicata, *p*. 40.
- *a*. Dorsal aspect, nat. size.
- *b*. Side view (enlarged) of the umbonal pore.
- *c*. Ventral aspect enlarged.
- *d*. Side view, nat. size.
- *e*. Ventral aspect, ditto.

Tab. II.

1



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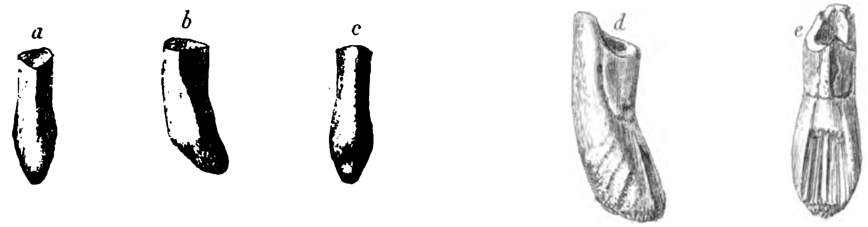

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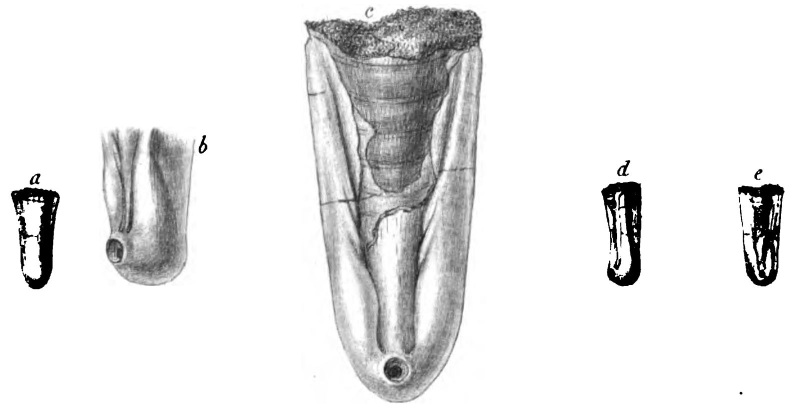


J. De C. Sowerby fecit.

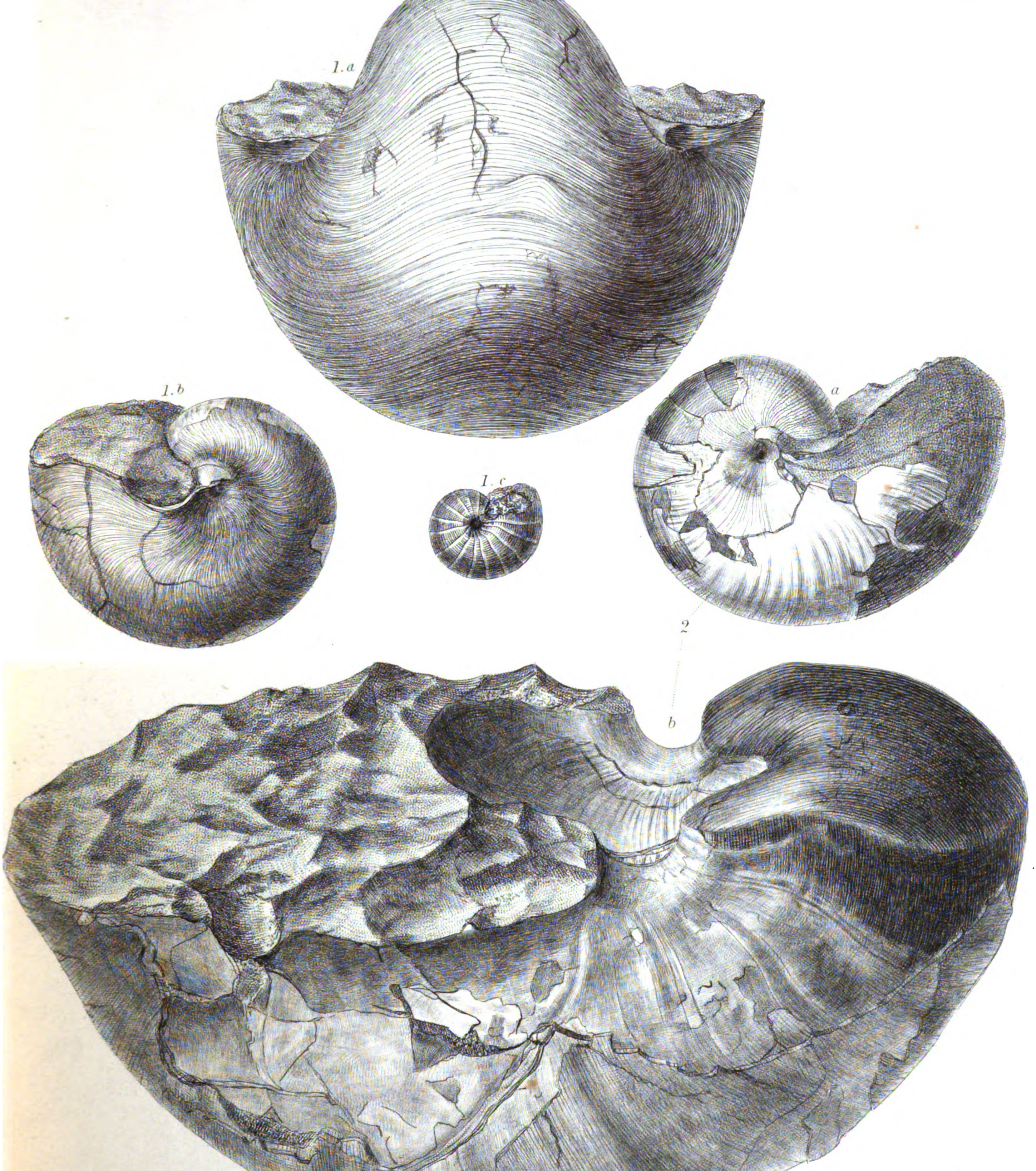
## TAB. III.

Fig.

1*a*—*c*. Nautilus centralis, *p*. 45.
  *a*. Back view.
  *b*. Side view.
  *c*. Do., young shell.

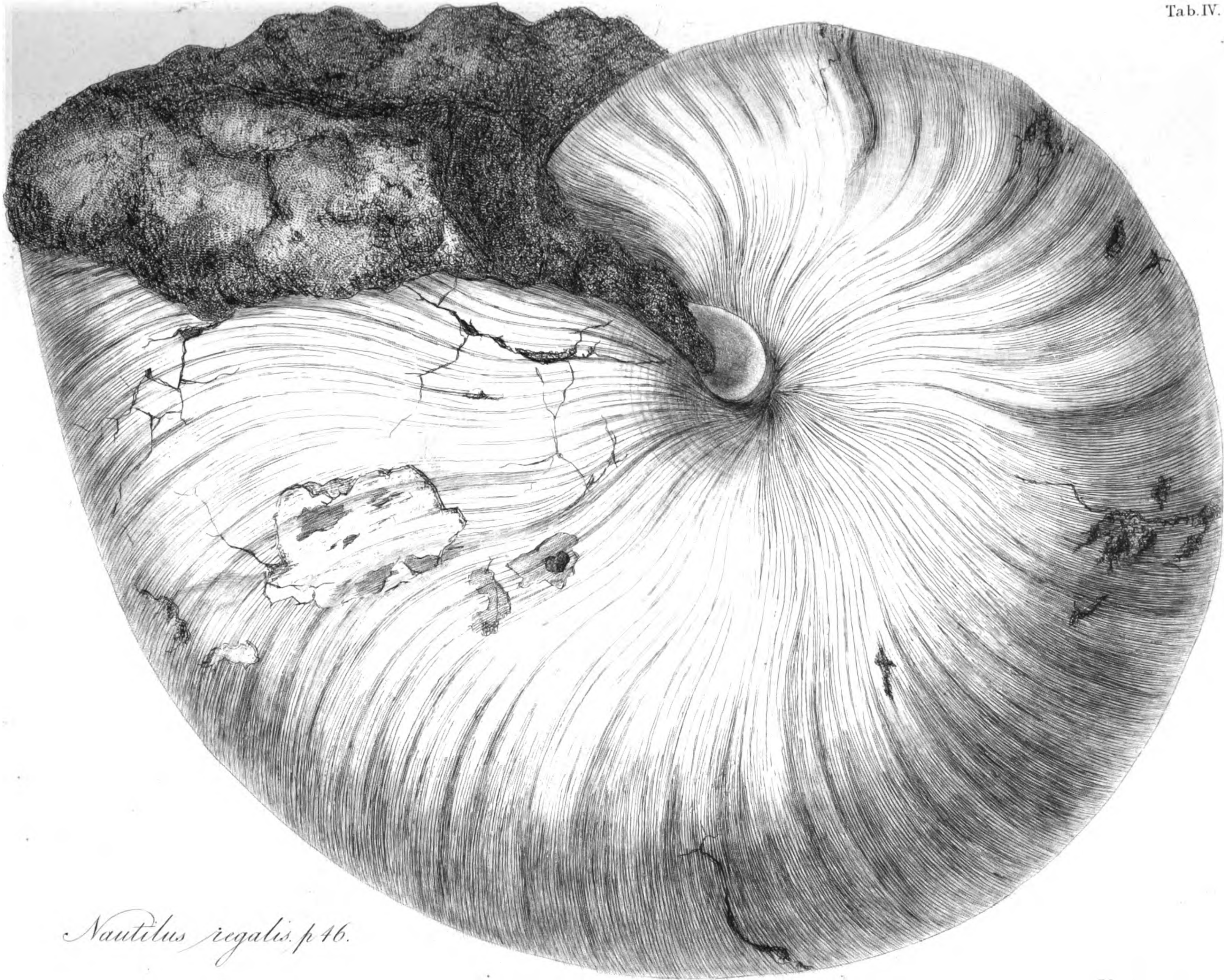
2*a*—*b*. Nautilus urbanus, *p*. 46.
  *a*. Side view, young shell.
  *b*. Do., adult do.

Tab. III.



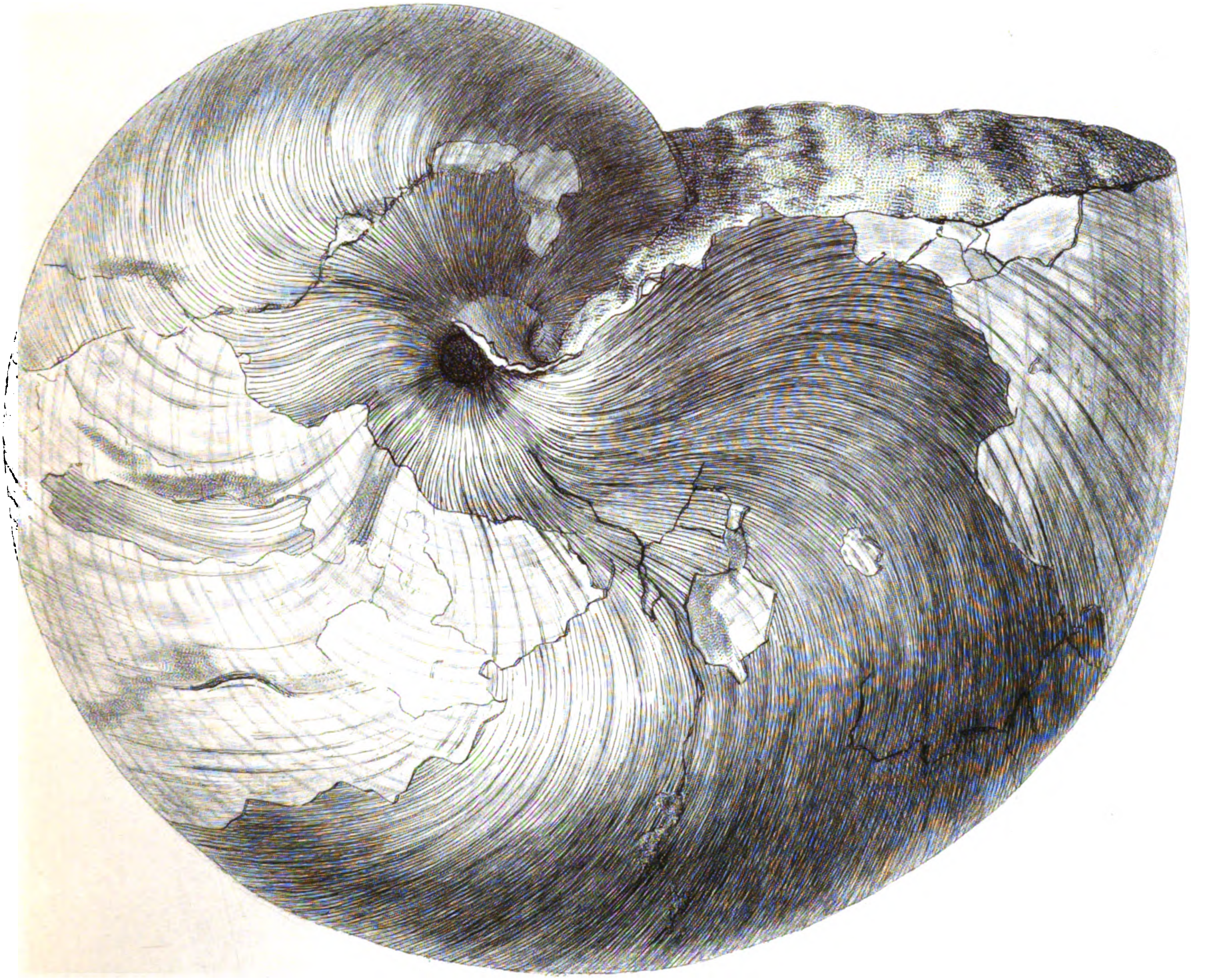
J De C. Sowerby fecit.

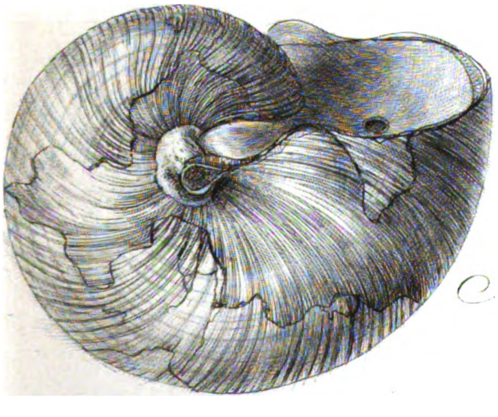
Tab. IV.

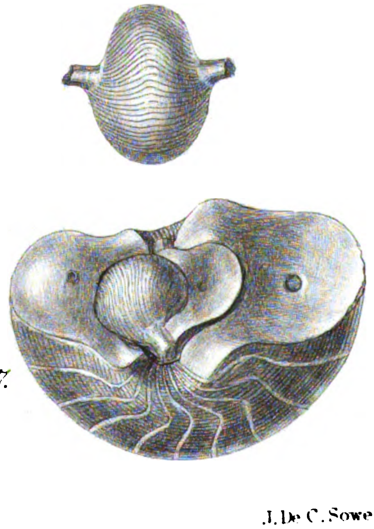


*Nautilus regalis. p 16.*

J. De C. Sowerby fecit.



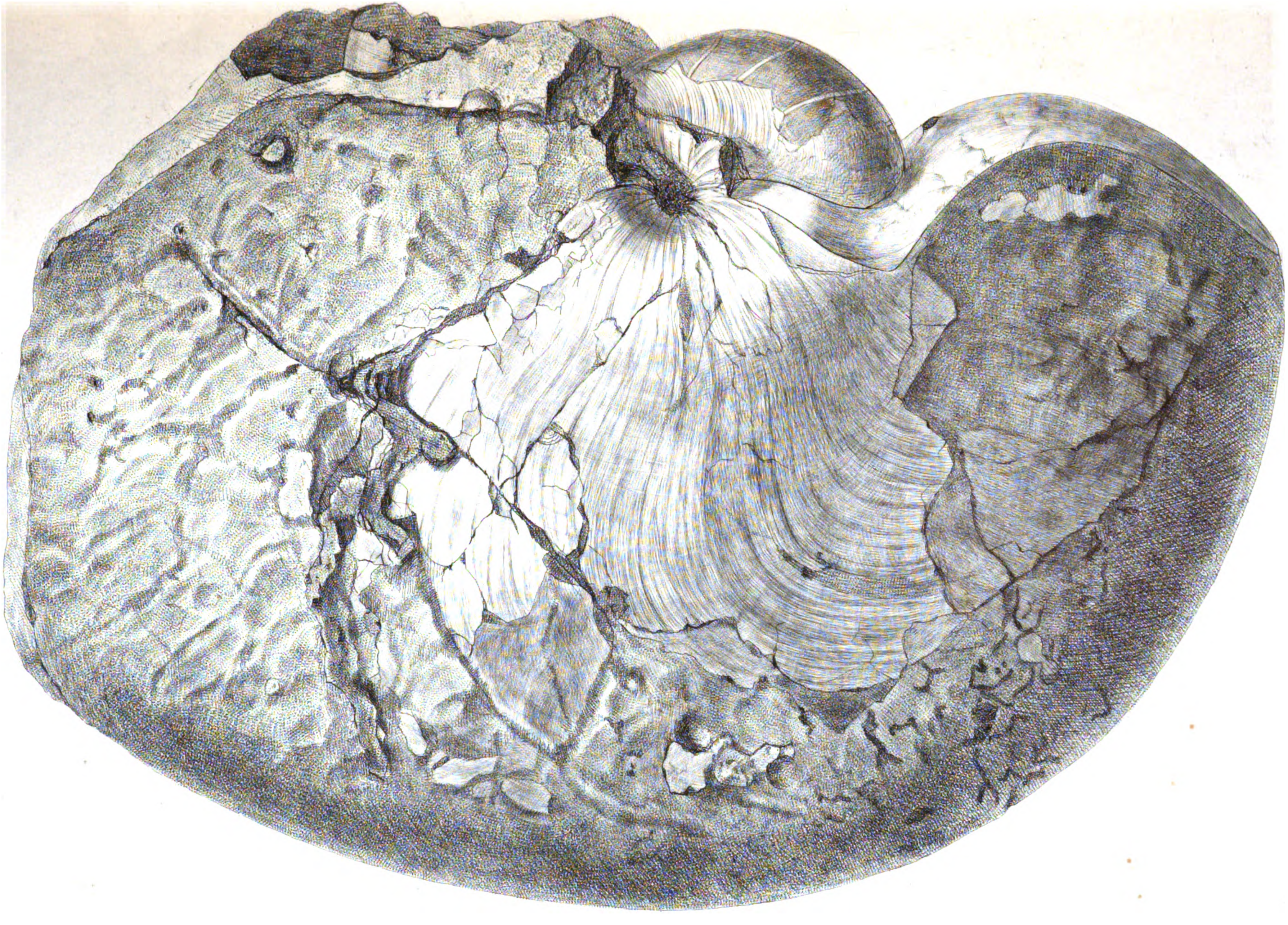




Nautilus imperialis p.47.

J. De C. Sowerby fecit

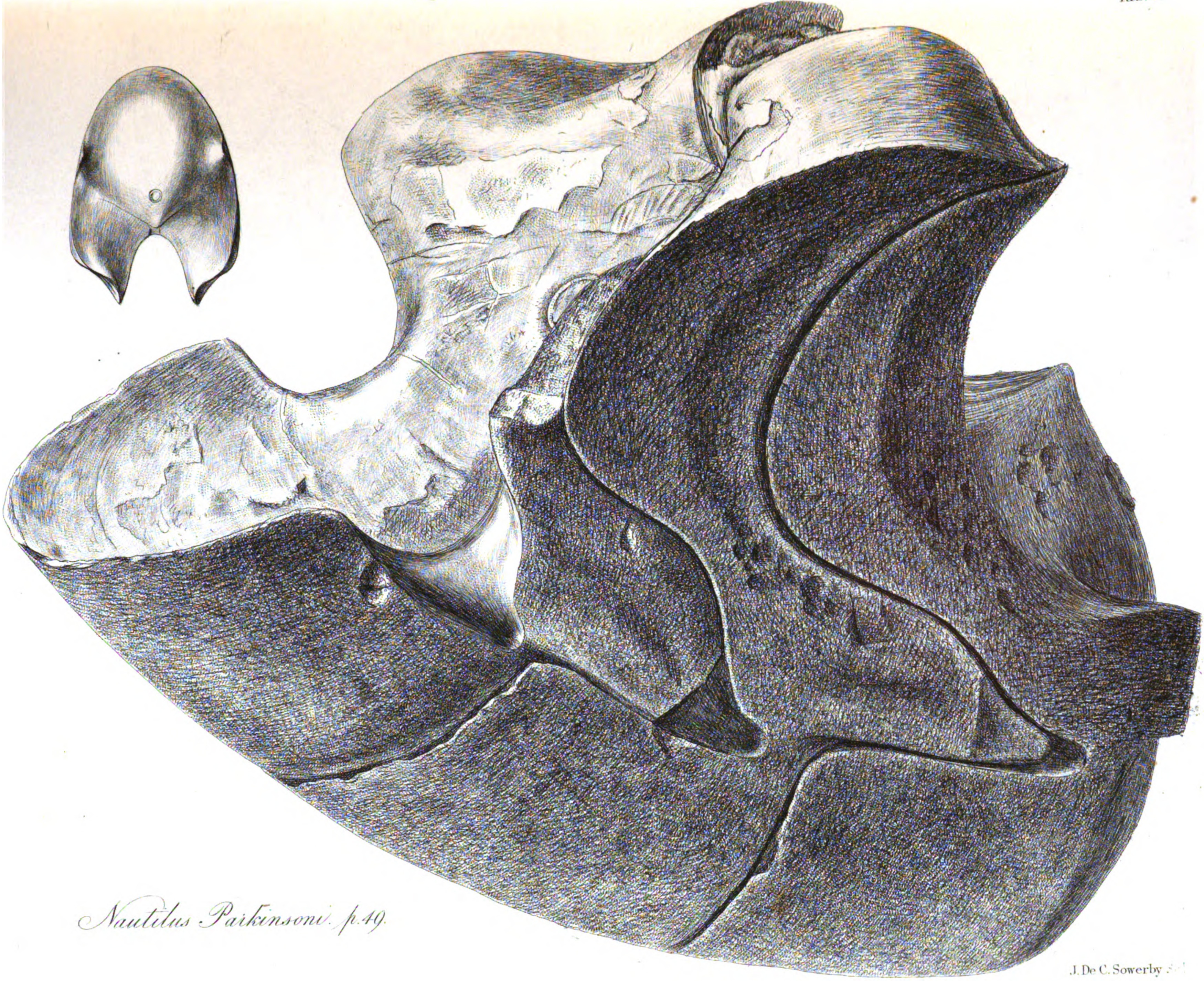
Tab. VI.



*Nautilus Sowerbyi. p. 48.*

J. De C. Sowerby fecit

Tab. VII.



*Nautilus Parkinsoni.* p. 49.

J. De C. Sowerby

## TAB. VIII.

Fig.

1. Transverse section showing the form of the septum in Nautilus imperialis, *p*. 47.

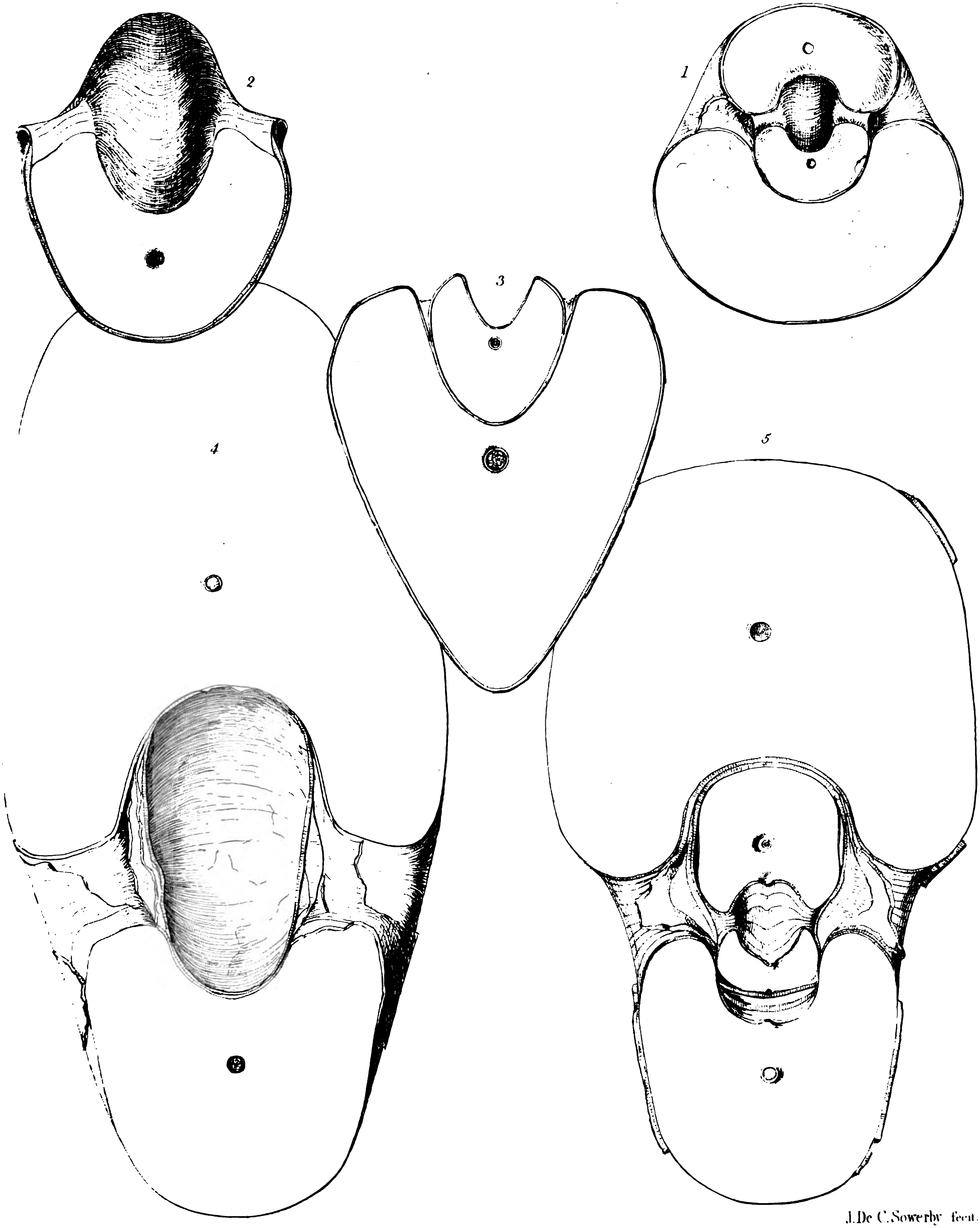
2. Do. do. N. centralis, *p*. 45.

3. Do. do. N. Sowerbyi, *p*. 48.

4. Do. do. N. urbanus, *p*. 46.

5. Do. do. N. regalis, *p*. 46.

Tab. VIII.



J. De C. Sowerby fecit.

## TAB. IX.

Fig.

1*a*—*h*. Aturia zic-zac (English specimens), *p*. 52.

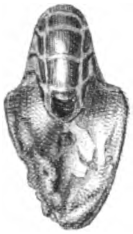
*a*. Side view of the typical form, from Highgate.
*b*. Front view do. do.
*c*. Side view do. from Sheppy.
*d*. Front view do. do.
*e*. Side view do. from Bracklesham Bay.
*f*. Front view do. do.
*g*. Side view of the compressed variety (β), from Chalk Farm.
*h*. Front view do. do.

2 and 3. Aturia zic-zac (Dax specimens).

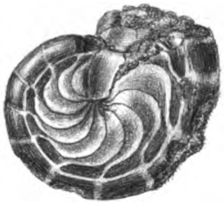
2. Oblique view, showing the construction of the siphuncle.
3. Front view, showing the form of the septum.

Tab. IX.

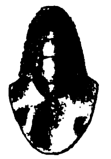
1.b



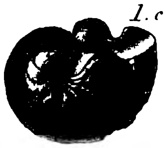
1.a

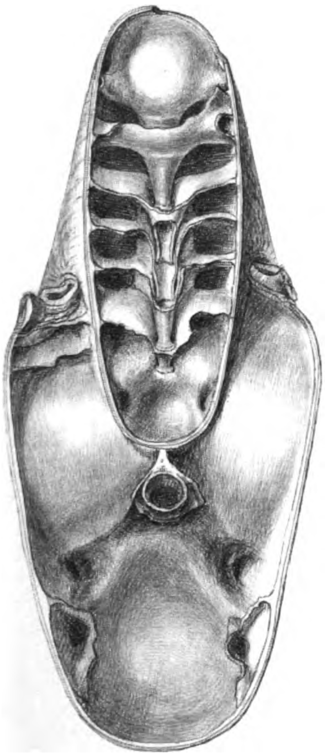


1.d



1.c





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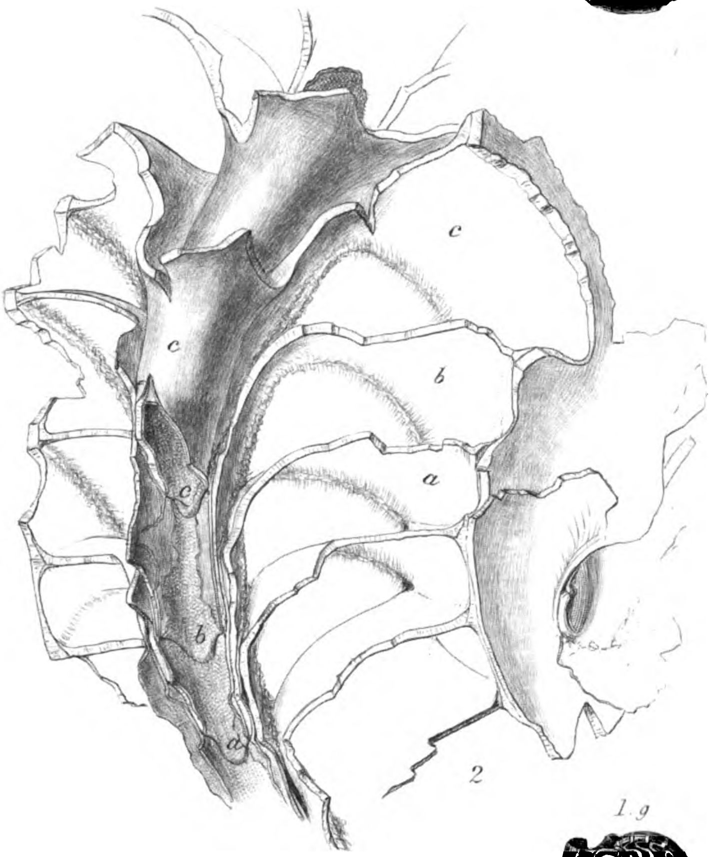
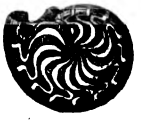
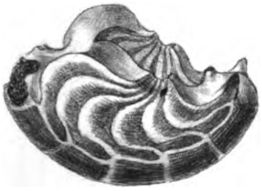


2

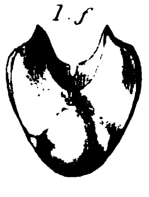
1.g



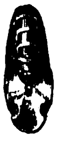
1 e



1.f



1.h



THE

# PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

LONDON:

MDCCCLII.

# A MONOGRAPH

OF

# THE EOCENE MOLLUSCA,

OR

## DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES OF ENGLAND.

BY

FREDERIC E. EDWARDS.

## PART II.

## PULMONATA.

LONDON:
PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.
1852.

C. AND J. ADLARD, PRINTERS, BARTHOLOMEW CLOSE.

# To the Subscribers.

SHORTLY after the publication of the first part of the Monograph of the Eocene Mollusca, I received a note from Professor Owen, from which the following is an extract:—

"In reference to the theory of the siphon of the Nautilus, which you attribute to Mr. Wood, I know you will excuse my referring you to a passage (p. 331) of my Lectures on Invertebrata, in which that theory or function of the siphon is plainly though briefly laid down, and I am sure that our excellent Treasurer would be the last person to claim the exclusive credit of the idea, unless his right to it was based on a publication of it prior to 1843. The scrupulous care which characterises your reference to authorities, assures me that if you have overlooked the passage in my Lectures you will be glad to be referred to it."

Although I had derived much pleasure and instruction from Professor Owen's admirable Lectures, I must confess that the passage referred to had escaped my recollection; and I greatly regret that this should have been the case, for I should have been glad to have availed myself of the powerful support it affords to the theory I advocated. For the convenience of those Subscribers to whom the Lectures are not immediately accessible, I shall extract the passage to which Professor Owen refers. After noticing Dr. Buckland's theory of the hydrostatic action of the siphuncle, and the objections against it, the Professor advances the opinions to which I have referred in the 'Monograph,' as to the function of the air-chambers being that of a balloon, and as to the mode in which the animal alters the specific gravity of its shell; and he concludes with the following paragraph,—the one referred to in his letter to me:

"Whatever additional advantage the existing Nautilus might derive by the continuation of a vascular, organised, membranous siphon through the air-chambers, in relation to the maintenance of vital harmony between the soft and testaceous parts, such, likewise, must have been enjoyed by the numerous extinct species of the tetrabranchiate Cephalopods, which, like the Nautilus, were lodged in chambered and siphoniferous shells."

It is due to Professor Owen that I should, to the best of my power, repair my omission to refer to this eminently suggestive passage; and now, having brought it distinctly before the Subscribers, I leave it to them to decide as to whom the credit of the siphuncular theory in question is due.

F. E. E.

*July*, 1852.

## CORRIGENDA.

*Substitute* Sconce *for* Headon Hill, at p. 65, line 24; at p. 70, line 13; and at p. 78, line 15.

# A MONOGRAPH

OF THE

# MOLLUSCA FROM THE EOCENE FORMATIONS OF ENGLAND.

## ORDER—*PULMONATA.* CUVIER.

PNEUMOBRANCHIATA, *Lamarck.*
PULMOBRANCHIATA, *De Blainville.*
PULMONIFERA, *Fleming.*

THE Molluscs forming this order breathe the free air by means of a chamber termed the pulmonary sac or cavity, placed beneath the dorsal surface of the anterior part of the mantle, and communicating with the atmosphere by a lateral opening, which can be dilated or contracted at the pleasure of the animal. The roof and walls of this chamber are lined with a network of pulmonary vessels, by which the blood is exposed to the air, and the renewal of this vital fluid is effected by movements of the floor of the chamber, analogous with those of the diaphragm.

The Pulmonated Molluscs are furnished with eyes, which are either placed at the anterior extremities of two elongated cylindrical peduncles, or seated in the head of the animal. Most of the genera in which the eyes are pedunculated, are also furnished with shorter cylindrical tentacula, placed beneath the peduncles, but in some few instances these appendages are wanting. In the genera in which the eyes are sessile, the animal is furnished with two sub-cylindrical or compressed tentacles only. The sessile eyes are variously placed; in some genera they are seated at the inner sides of the bases of the tentacles; in others at the outer sides; and in others on the frontal disc. The peduncles and tentacles are both contractile, and in by far the greater number of genera they are also retractile, that is, capable of being withdrawn under the skin. They are eminently sensitive organs of touch.

The head is well developed, and the mouth is provided with an apparatus consisting of a horny dentated plate, placed transversely across the upper part, and the sharp outer edge of which forms, as it were, the upper jaw. The cavity of the mouth is furnished with a thin cartilaginous tongue, the anterior extremity of which is of a flattened spoon-like form, and which plays against the edge of the horny plate, answering the purpose of an under jaw. The remainder of the tongue is rolled up into a tube closed at the end, and thickly covered with teeth, distributed in transverse rows of various forms. The number of these teeth is almost incredible, amounting, in one of the English slugs (*Limax maximus*) to nearly 27,000, and ranging in several of the snails from 10,000 to upwards of 20,000.* A dentition of a similar character prevails among the Branchiated Gasteropods; and Professor Lovén has proposed the employment, for the purposes of classification, of characters taken from the form and arrangement of the teeth.

The free air-breathing Molluscs are, in some few instances, viviparous,† but, for the most part, they are oviparous. The eggs are either enveloped in a skin, or are covered by a hard calcareous shell, which, among the larger Bulimi and Achatinæ, is sometimes of considerable size. The larvæ are in all cases shaped like the parent. The generative organs present various modifications; in some genera the animals are unisexual; but more generally they are hermaphrodite.

These Molluscs are, with few exceptions, provided with hard calcareous shells, which are sometimes either internal or partly concealed beneath the mantle, but more generally are external, and large enough to contain the whole, or nearly the whole, of the animal. In some genera the foot of the animal is provided with a calcareous or horny operculum; in others the animal is without this appendage, and in the genus Clausilia, the purpose of the operculum is answered by a peculiar apparatus termed the clausium. The external shells present many modifications in the proportions and conditions, as well of the spire and volutions, as of the aperture and columella. Certain of these forms are accompanied by corresponding peculiarities of organisation, and the genera which have been established for their reception may be considered types in this order; such are the genera Helix, Bulimus, Pupa, Succinea, Limnæa, Physa, Planorbis, Cyclostoma, Helicina, Auricula, &c., and the Palæontologist will have little difficulty in distinguishing them. Other genera, however, have been proposed from time to time on characters taken from modifications of these typical forms; but a more intimate acquaintance with the anatomy of the animals has latterly induced great caution in the admission of these genera; since, in many cases, the Malacologist, after the most careful investigation, has failed to detect any peculiarity of organisation corresponding with the modifications of the shell. In the extensive family of the Helicidæ, most especially, has this occurred, and many of the genera thus formed are consequently either wholly rejected, or received provisionally until it is ascertained by further examination whether or not there is anything except merely artificial characters to support them.

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* For a more detailed account of the oral apparatus, the reader is referred to Mr. W. Thompson's highly interesting "Remarks on the Dentition of British Pulmonifera," in the 'Annals and Mag. of Nat. Hist.,' 2d series, vol. vii, p. 86.

† This is the case with some species of Helix, and with several species of Bulimus, for which Férussac, on this ground, proposed the genus *Partula*.

The Gasteropods forming this order are all phytophagous. They are very widely spread, being found in almost all parts of the earth, but they principally abound in warm or tropical climates, where the largest species occur. They are, for the most part, inhabitants of land, but many live in water, coming to the surface for respiration; of those which live in water, the greater number inhabit ponds, running streams, or stagnant waters, but some few are marine animals, frequenting the shallow sea near the shores, or salt-water marshes.

Two distinct forms of the opening by which the communication between the pulmonary sac and the external air is kept up, are presented; and as each appears to be accompanied by corresponding peculiarities of organisation, Mr. Gray has availed himself of them for dividing the order into the two sub-orders, *Adelopneumona* and *Phaneropneumona*.* In the first division the communication is through a lateral orifice formed by the edge of the mantle, which, except at that part, is united along the left side of the animal; in the second division the edge of the mantle is free or detached along the nape, leaving the pulmonary cavity open. The animals comprised in the first division are all hermaphrodite, and without an operculum; while, on the contrary, those which form the second division are unisexual and operculated. The genera constituting this order had previously been divided, according to their habitats, into terrestrial and aquatic (*terricola* and *aquatica* of Dr. Fleming); a mode of distribution which brought together animals presenting important zoological differences. This principle of subdivision may, however, be used with convenience in the Adelopneumona, and Mr. Gray has, in fact, divided that sub-order into the three sections, *Geophila*, *Limnophila*, and *Thalassophila*, the last two representing the *aquatica* of Fleming.†

Mr. Webster many years ago, ('Geol. Trans.,' vol. ii,) noticed the occurrence in the Purbeck beds of fossils resembling fresh-water shells, and in the Museum of Practical Geology is a series of fossils from that formation, comprising Limnæa and Planorbis. Fossil remains, referred to the genus *Auricula*, have also been found, according to M. Nyst, in the chalk formation in the department of the Aube in France. In the fresh-water deposits of the Eocene epoch, remains of numerous species belonging to various of the land and fresh-water genera, constituting this order, occur in abundance. These species are, for the most part, without any living analogue, but some few occur which appear to be identical with species still in existence.

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* Etym., Αδηλος, (hidden, concealed,) and φανερος, (open, exposed,) prefixed to πνευμων, (the lungs.) These sub-orders correspond with the divisions *inoperculata* and *operculata*, proposed by Férussac, and adopted by Dr. Turton, M. Rang, and others, but as the names used by Mr. Gray express modifications of the respiratory apparatus, which forms the character of the present order, I have adopted them, although the words operculata and inoperculata are preferable from their simplicity.

† Etym., γεα (land), λιμνη (a pool or marsh), and θαλασση (the sea), respectively prefixed to φιλος (loving).

I believe that, as yet, remains of land inhabiting genera have not been found below the Eocene formations. It must not, however, be assumed from that circumstance that these latter forms of animal life date their existence with the Eocene Epoch. The older formations with which Geologists are at present acquainted, are, with the exception of the Wealden group and the Coal-measures, of marine origin; and the preservation in them of the remains of land-shells would be due only to accidental circumstances. Individuals might occasionally be transported by rivers or currents of water into estuaries, or be swept away by an irruption of the sea. To such a cause is to be attributed the presence of a specimen of *Bulimus ellipticus*, found by Mr. Wetherell in the London Clay at Primrose Hill; but the number deposited in the bed of the deep sea by the agency of such casualties, must necessarily be small, and it need not excite surprise that their remains have not occurred in the older formations.

### SUB-ORDER—*ADELOPNEUMONA* (Gray), *INOPERCULATA* (Férussac).

Sect. α. TERRICOLA, *Fleming*.
GEOPHILA, *Férussac*.

### *Family*—HELICIDÆ.

### Genus 6th. HELIX. *Linn.*, 1758; *Brug.*, 1792; *Lam.*, 1801.

Shell turbinated, orbicular, sub-globose, or depressed; spire more or less elevated, with several convex whorls, generally smooth; the last often large and ventricose; aperture entire, transverse, oblique, lunate, or semi-ovate, impressed by the prominent part of the body whorl, and sometimes furnished with one or more lamelliform teeth; peristome confluent with the columella, generally thickened internally, or having the edge reflected, especially on the side covering the umbilicus; without an operculum.

Notwithstanding that in Lamarck's time but little was known of the comparative anatomy of the animals belonging to this family, we must concur in the regret expressed by M. Deshayes (2d edit., 'Hist. Nat.,' &c.) that that illustrious naturalist did not attempt a systematic arrangement of the numerous species forming this genus.

A much more intimate knowledge of the anatomy of the animals has since been acquired; and it appears that, although the shells present a great variety of forms, differences of organisation of importance sufficient to justify the separation of genera to receive them, do not exist, or, at all events, have not been observed in the animals. This strong general resemblance extends, in fact, to the whole of the

Helicidæ, and induced M. de Férussac to arrange the different genera as sub-genera merely of the typical genus Helix.

The present genus, as defined by Lamarck, embraces considerably more than a thousand living species; and may well be considered to be "deserving of subdivision, were it only to assist the student in the difficult task of investigation." Very many genera and sub-genera (amounting, including the synonyms, to nearly two hundred,) have, in fact, been proposed from time to time by different authors; but being nearly all founded, more or less, on conchological differences, they are, with few exceptions, rejected by the advocates of a strictly natural arrangement. M. Deshayes, one of the most able advocates for a system of arrangement dependent on anatomical structure, admits the convenience of having recourse to artificial divisions in this genus in which it is impossible to form natural groups; and suggests that the Helices may be classed, by the form of the shell, in four sections, consisting of the planorbular species, (*Zonites*, Montfort; *Helicella*, Lamarck,) the globose species, (*Acavus*, Montfort,) the carinated species, (*Iberus*, Montfort; *Carocolla*, Lamarck,) and the trochiform or turbiniform species (*Petasia*, Beck; *Geotrochus*, Swain.): and that these sections may be again subdivided into groups, according as the species are or are not umbilicated, have the aperture simple or reflected, or are or are not furnished with teeth.

The fossil Helices are more numerous than might be expected with respect to land-shells. Many extinct species, from the Freshwater deposits of the Paris basin, have been described by MM. Brogniart, ('Ann. du Mus.' vol. xv, p. 378,) Deshayes, ('Descr. des Coq. Foss.,' &c., vol. ii,) Matheron, ('Ann. des Sci. et de l'Indust. du Midi,' vol. iii,) Michaud, ('Guerin's Mag. de Zool.,' 1837,) De Roissy, ('Guerin's Mag. de Zool.,' 1839,') and Melleville, ('Mém. sur les Sables Tert. Inferieurs du Bassin de Paris,' p. 45;) and from the contemporaneous Freshwater formations in Germany by MM. Zeiten, ('Petr. Wurt.,' tab. xxix and xxxi,) Steininger, ('Bull. Soc. Géol. de France,' vol. vi,) Deshayes, ('Ency. Méthod. Vers.,) and Pusch, ('Polens. Pal.,' p. 94.) One species only, *H. globosa*, has as yet been described from the synchronous deposits in England; to this I am enabled to add eight species, one of which is identical with an existing species, *H. labyrinthica*, Say., found in North America.

Many species also occur, mixed with marine remains in the Miocene formations of Touraine, Dax, and Bordeaux, and in the Pleiocene formations of Piedmont, the Crag of England, and its equivalent in Belgium; of these but few are extinct, by far the greater number being referred to existing species.

Among the French species described by M. Deshayes is one (*H. dubia*), which, on the authority of Mr. Underwood, is mentioned as occurring in the Isle of Wight. I have not met with any specimen from that place; and M. Deshayes, as I learn from that gentleman himself, entertaining doubts as to the English locality, I have not considered *H. dubia* as an English species.

### No. 14. HELIX VECTIENSIS. *F. E. Edwards.* Tab. X, fig. 8 *a—e.*

*H. testâ orbiculato-depressâ, umbilicatâ; superficie punctulis minutissimis confertis aspersâ; spirâ parum elevatâ; anfractibus quinque sub-rotundatis, suturis depressis; aperturâ semi-ovali, peristomate reflexo: umbilico profundo, semi-obtecto.*

A somewhat convex shell, having the surface thickly covered with minute punctules. The slightly elevated spire is composed of about five bluntly convex whorls, depressed at the sutures. The aperture is semi-ovate, having the margins strongly reflected; that of the inner lip partly covering the umbilicus, which is deep and moderately wide. The shells, when in the young state, are, like many others in this genus, slightly carinated. In the general contour, this species much resembles the recent *H. rufescens*, but it is distinguished as well by the punctulated surface, as by the less rounded whorls, the more strongly reflected peristome, and the larger umbilicus.

Casts in the Limnæan limestone at Sconce are not uncommon; but specimens with the shell preserved are rare. The casts may be separated from those of *H. D'Urbani*, with which, at first sight, they are liable to be confounded, by the narrower umbilicus, and frequently by the impression of the reflected lip of this species. Where the shell is preserved, the punctulated surface presents a character by which it may be at once distinguished.

Diameter, 4-10ths of an inch; elevation, 2-10ths in.

*Localities.*—Sconce near Little Yarmouth, and Headon-Hill, Isle of Wight.

### No. 15. HELIX D'URBANI. *F. E. Edwards.* Tab. X, fig. 5 *a—d.*

*H. testâ orbiculato-depressâ, lævi, umbilicatâ: spirâ subprominulâ; anfractibus quinque aut sex sub-rotundatis; suturis perspicuis: aperturâ semi-ovali, peristomate simplici; umbilico magno.*

A smooth, depressed, umbilicated shell, with a slightly elevated spire; the five or six volutions of which it is composed are bluntly convex, and the upper edges are so much depressed as almost to present a channel at the suture; the aperture is semi-ovate, with a perfectly simple unreflected lip; the umbilicus is wide, disclosing the volutions within.

This species somewhat resembles *H. Lemani* of Brogniart, but the spire is less elevated, and the umbilicus is more open.

The smooth and polished surface, which barely shows the lines of growth, and the sharp lip prevent its being confounded with *H. Vectiensis.* When young, the whorls are slightly carinated. A variety occurs in which the spire is much depressed, and the whorls consequently assume a less bluntly convex form.

The species is not uncommon; but most generally casts only are found. In that condition the wide umbilicus is the only character by which it can be separated from *H. Vectiensis*.

Diameter, 4-10ths of an inch nearly; elevation rather more than 2-10ths in.

*Localities.*—Sconce and Headon-Hill.

I have much pleasure in dedicating this species to my friend John D'Urban, Esq., whose Palæontological pursuits have enabled him to add several interesting species to our Eocene Fauna.

### No. 16. Helix globosa. *Sowerby.* Tab. X, fig. 2 *a—d.*

H. globosus. *Sow.* 1818. Min. Con., vol. ii, p. 157, t. 170.
— *Morris.* 1843. Cat. of Brit. Fos., p. 147.

*H. testâ globoso-conoideâ, apice obtuso: anfractibus sex aut septem, transversim substriatis, ultimo anfractu ad basin convexo; striis numerosis, irregularibus, tenuissimis; suturis perspicuis; aperturâ depressâ, semi-lunari, marginibus reflexis; columellâ sub-rectâ; umbilico obtecto.*

This well known shell is globosely conical, with an obtuse apex; the spire is formed of six or seven whorls, which exhibit obscure, transverse, irregular striæ, or lines of growth, so faint that, as Mr. Sowerby remarks, they are only to be seen in the best preserved specimens. The base of the shell is very tumid, rising from the periphery of the whorl with a bluntly convex swell until it nearly reaches the umbilicus, into which it sinks abruptly, imparting an almost vertical slope to the columella. The aperture in the adult shell is semilunate and depressed, with the margins reflected, that of the inner lip entirely concealing the umbilicus. The young shell, like that of all the globosely conical shells of this genus, presents a form very different from that of the mature one. When in the young state, the whorls are subcarinated, increase rapidly in size, and consequently are very convex, giving a sub-quadrate form to the aperture; and the shell presents a small umbilicus: but, as the shell approaches maturity, they lose their sub-carinated form, increase in size more and more slowly, and become less and less convex in their contour, so that, in the mature state, the aperture assumes a semilunate form, and at this period of growth the umbilicus is concealed by the reflected margin.

Specimens with the shell preserved are extremely rare, but casts in all stages of growth are comparatively common at Sconce Point. In the young state the casts resemble those of *Helix occlusa;* but the flattened base, the shorter and more oblique columella, and the semi-ovate aperture, serve to distinguish the latter species.

I am indebted to Mr. Sowerby for the use of the original specimen described in the 'Mineral Conchology,' from which the larger figures are taken; fig. 2 *a* is from a specimen in the cabinet of Mr. D'Urban.

Diameter, 2 iuches; elevation, 2·3 in.

*Localities.*—Shalcome (near Ryde) and Sconce, Isle of Wight.

### No. 17. HELIX OCCLUSA. *F. E. Edwards.* Tab. X, fig. 10 *a—e*,

*H. testá sub-globosá, fulvo uni-fasciatá; spirá prominulá, quinquies vel sexies circumvolutá; anfractibus convexiusculis, ad suturam depressis, obscure ad basin striatis, subplanulatis; aperturá semi-ovatá, marginibus parum reflexis: margine columellari umbilicum occludenti.*

A sub-globose shell, with a somewhat elevated spire, composed of five or six rapidly enlarging convex whorls, depressed round the suture, and flattened on the base. The surface presents numerous, very faint, oblique, irregular striæ, produced by the lines of growth. The aperture is of a regular semi-ovate form, having the margins slightly reflected; the inner lip spreads over, and entirely closes the umbilicus. The shell is ornamented by a narrow, brownish-yellow band running round the whorls, just above the line of the suture, the colouring matter of which is retained, more or less, in all the specimens I have seen, in which the shell is preserved.

This is a well-marked species, easily distinguishable when the shell is preserved. The casts, which are more commonly found, resemble those of the young shell of *H. globosa,* but can be separated from them without difficulty by the flattened base and oblique columella which present a strong contrast with the tumid base, and nearly vertical columella of that species. The smaller number of the whorls and the narrower umbilicus separate it as distinctly from *H. Vectiensis* and *H. D'Urbani.*

Diameter, 1·2 in.; elevation, ¾ in., nearly.

*Localities.*—Sconce and Headon Hill, where it occurs more rarely than any of the preceding species.

### No. 18. HELIX TROPIFERA. *F. E. Edwards.* Tab. X, fig. 3 *a—c.*

*H. testá orbiculari, supra plano-convexá, subtús convexo-turgidá, umbilicatá: spirá plus, minusve elevatá; anfractibus quinque aut sex, ad peripheriam subcompressis, et carinatis; aperturá transversá, subtrigoná; marginibus reflexis umbilico magno.*

I have seen two specimens only, both casts, of this Helix; from the character of the whorls and the aperture it would belong to Lamarck's genus *Carocolla,*—the *Chilotrema* of Dr. Leach. It is an orbicular shell, with a slightly elevated spire, apparently variable in height; the upper sides of the five or six whorls, of which it is formed, are nearly flat, and somewhat compressed near the periphery, which presents a sharp keel; the under side is tumidly convex, rising with a regular swell until it approaches the umbilicus, into which it sinks rather suddenly, presenting a blunt angle which defines the umbilicus. In the smaller of the two specimens, the spire is more elevated, and the underside of the body-whorl more convex than in the other. The umbilicus is deep and moderately wide; the aperture transverse, and wider than long. The specimen figured exhibits the impression of a slightly reflected peristome.

The present species is much less than the recent *H. lapicida*, the umbilicus is smaller in proportion, the keel round the whorls more prominent, and, judging from the cast figured, which appears to be that of a fully-grown shell, the aperture at maturity does not present the downward inflection which characterises *H. lapicida.* The condition of the keel is apparently a character of little value, inasmuch as it varies considerably in specimens of *H. lapicida,* some of which, particularly in the young state, have it as acute and prominent as that of the present shell.

The smaller size of the umbilicus, and the absence of the downward inflection of the aperture, are the most important differences; but these characters, even if constant, would scarcely justify my considering the shell as more than a variety. With only two specimens, however, and those casts, I do not venture to pronounce as to their identity with the recent species. If, on more perfect specimens being obtained, it should appear that the shell presents the granulated surface which characterises *H. lapicida,* I should feel little hesitation in referring it to that species.

The specimen figured belongs to Mr. D'Urban's collection.

*Size.*—Diameter, ½ an inch; elevation rather more than 2-10ths in.

*Locality.*—Headon Hill, where, however, it is extremely rare.

### No. 19. Helix omphalus. *F. E. Edwards.* Tab. X, fig. 5 *a—e.*

Helix striatella. *S. Wood.* Lond. Geol. Journ., vol. i, p. 118.

*H. testâ planorbulari, depressâ, undato-costulato-lineatâ, umbilicatâ: anfractibus quaternis, convexiusculis; suturis conspicuis, depressis: aperturâ rotundato-semi-lunari; marginibus simplicibus; umbilico magno.*

This shell, which belongs to the section represented by *Zonites,* Montfort,*

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* The genus *Zonites,* as defined by Mr. Gray, embraces those Helices which have a depressed spire and a lunate mouth, with thin simple lips. It is divided into two sections—*Verticillatæ* (Fér.), in which the shell is brown, or varied, and striated; and *Hyalinæ* (Fér.), in which the shell is hyaline, greenish or pale brown, and polished. It appears, from the observations of Mr. W. Thompson, to which I have before referred, that, judging from the characters afforded by the dentition, the animal of *Z. radiatus* (one of the *Verticillatæ*) is a true Helix; but that in four species of the *Hyalinæ* examined by him, the animals would form a connecting link between Vitrina and the true Helices. Professor E. Forbes and Mr. Hanley, in their 'History of British Mollusca,' restrict the genus to the Hyaline species.

(*Helicella*, Lamarck,) is somewhat discoidal, with a slightly elevated spire formed of about four whorls, generally rounded or bluntly convex, but which, in two casts of fully grown individuals in my cabinet, present a sub-carinated periphery. The surface is covered with numerous regular raised lines, separated by shallow rounded sulci; the lines are oblique, undulating, and rounded. The margins of the depressed semilunar aperture are simple and unreflected. The umbilicus is moderately wide.

Mr. S. Wood, in his 'List of Shells from Hordwell Freshwater Bed,' has referred this shell to the North American species, *H. striatella*, Anthony; but, although I feel great hesitation in dissenting from his opinion, the differences between the two render it difficult to maintain their identity, at all events, before we are better acquainted with the influence of external conditions in modifying the forms of the animal and its shell. I should add that I have only one specimen with the shell preserved, (the one referred to by Mr. Wood, and which he has been kind enough to add to my collection,) and that this specimen is in an imperfect state. On comparing this shell with the recent *H. striatella*, it will be seen that in the latter species the spire is more elevated, the lineation sharper, the sulci not so deep, the whorls wider, rounder, and less embracing; the suture not so depressed, and the aperture larger. Similar differences exist between this and *H. ruderata*, a species from Cincinnati described by Binney. In *H. perspectiva*, Say, which it somewhat resembles, the spire is more depressed, the lineation, like that of *H. striatella*, is fainter and sharper, the volutions more numerous, the peritreme more distinctly carinated, and the umbilicus wider.*

A shell occurs in the Pleistocene freshwater deposit at Clacton, which is referred to *H. ruderata:* the striation resembles that of the present shell; but in other respects it very closely resembles the American shell. M. Deshayes has described a fossil shell from the upper freshwater formation of the Soissonnais (*H. Ferrantii*), to which this species presents a general resemblance; but it is separated from that shell by the more elevated spire, and the more numerous whorls; and in *H. Ferrantii* the raised lines appear to be fewer and less regular, and the umbilicus to be narrower.

*Size.*—Diameter ¼ of an inch, nearly; elevation 1-10th inch.

*Localities.*—Hordwell Cliff; Sconce.

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* The *H. striatella* of Anthony is from Massachusetts, and, until recently, was considered to be merely a variety of Say's *H. perspectiva*, which is from Ohio and Lake Erie. Gould, in his 'Report on the invertebrate Animals of Massachusetts,' has pointed out the distinctions. The *H. ruderata* of Binney is from Cincinnati, and has also been considered as a variety of *H. perspectiva;* it appears to belong rather to *H. striatella*.

### No. 20. Helix labyrinthica. *Say*. Tab. X, fig. 7 *a—e*.

Helix labyrinthica. *Say*. Journ. Acad. Nat. Sc. Philadelphia, vol. 1, p. 124.
— — *Nicholson's* Encycl. (Amer. Edit.), 4.
— — *Férussac*. Hist. Natur. des Moll., tab. li B, fig. 1; Prodromus, No. iii.
— — *Binney*. Boston Journal Nat. Hist., vol. iii, tab. xxiv, fig. 1.
— — *Gould's* Report of the Inverteb. of Massachus., p. 184.
— labyrinthicus. *S. Wood*. Lond. Geol. Journ., vol. i, p. 118.

*H. testâ minimâ, globoso-conicâ, transversim lineatâ, umbilicatâ; lineis obliquis, undosis, numerosis; spirâ plus minusve elevatâ, sexies circumvolutâ; anfractibus convexis ad basin sub-planulatis: aperturâ depresso-semilunari, peristomate reflexo: margine columellari uno dente lamelliformi instructo: umbilico magno, profundo.*

This pretty and very rare Helix is a small, roundedly-conical shell, with a more or less elevated spire, composed of about six gradually increasing whorls, separated by a clearly defined suture, and ornamented with numerous, elevated, obliquely transverse, equidistant, raised lines, more or less prominent in different individuals. These lines are somewhat acute, slightly undulated, and, running into the umbilicus, cover the whole surface of the whorls. The base of the shell is but slightly convex; the aperture of a depressed semilunar shape, with the peristome reflected. The columella lip presents a large lamelliform tooth, prolonged within the aperture, and running parallel with the suture. The umbilicus is deep and wide, being about one third of the diameter. In one specimen in my cabinet, the spire is very much depressed, almost planorbular, and the apex more obtuse.

This species derives additional interest from the fact that, having survived through the inconceivably long spaces of time required for the deposit of the Miocene and the more recent formations, and having become extinct in the hemisphere in which it first appeared, it is now found among the living forms of North America. The recent *Helix labyrinthica*, first described by Say, is spread over a wide range of country, extending from Ohio to Florida, and from Missouri to Texas. Specimens from Texas, Ohio, and Florida are preserved in the British Museum; and, after a careful comparison with them of the fossil shells, it appears to me that differences of sufficient importance for specific distinction cannot be detected between them; I therefore fully concur with Mr. S. Wood in the opinion expressed by him of their specific identity, and I do not hesitate to refer the fossil shell to Say's species.

In order to facilitate an examination into this identity, it will be useful to give Say's description in his own words. It is as follows: "Shell conic, dark reddish-brown; body lighter; whorls five or six, with conspicuous, elevated, equidistant, obtuse lines across, forming grooves between them; apex obtuse; lip reflected, rounded; pillar-lip with a large, lamelliform, elongated tooth, which appears to revolve within the shell parallel to the suture; a smaller raised line revolves nearer to the columella within the shell, but becomes obsolete before it arrives at the pillar-lip. Umbilicus large. Breadth 1-10th of an inch."

Taking the Texas shells, the form described by Say as the typical form of the American species, the fossil shell presents, on comparison, the following variations:

1st. The shell is somewhat smaller; the spire, except in the specimen I have noticed, is more elevated, the apex not so obtuse, and the whorls are less convex.

2d. The base of the shell is flatter, and the aperture not so rounded.

3d. The position of the larger raised line is more median, and the smaller raised line is wanting; and,—

4th. The peristome is simply reflected, and not "rounded" or thickened.

Now it will be seen that the differences firstly mentioned are such as frequently occur in a series of individuals of the same species. The variable height of the spire, evidenced in the fossil shells by the depressed form of the specimen before mentioned, is a character also found in the recent species; since Gould, in his work above cited, states expressly that "the shell varies considerably in the elevation of the spire, being sometimes much flattened, and again it has a pointed apex;" an observation, the accuracy of which the Florida specimens in the British Museum fully confirm; and this difference in the elevation of the spire will depend on, and in fact will denote, the less or greater convexity of the whorls.

With respect to the flatter base, and the consequently less rounded aperture, the same specimens from Florida exhibit a similar departure from the type; in one instance, indeed, the base is so much flattened as to impart a sub-carinated form to the basal periphery of the whorl.

The position of the larger tooth is equally variable in the Texas specimens; and, as regards the absence of the second or smaller raised line, Gould says that, "usually but one of them (*i. e.* of the raised lines) exists;" a statement, in fact, borne out by some of the specimens from Ohio in the British Museum, in which the second line is not perceptible.

It is evident, then, that these variations, occurring as they do in the recent shells, cannot afford sufficient grounds for a specific distinction of the fossil shell; and the only difference which apparently does not elude us on comparison, is the thickened or, as Say describes it, the rounded outer lip of the recent shells. To rest specific distinction on this character, one which, in general, is only an attribute of maturity, and which, even if constant, could, at the utmost, merely serve to designate a variety, would be an excess of refinement. But it cannot be affirmed that this variation is constant, and a larger series of the fossil shells may show that even the thickened outer lip is not wanting. Of the influence of varied conditions in modifying the form of shells, very little is known or even conjectured; but we may reasonably believe that a change in the ordinary conditions of temperature, and of the nature and supply of food, will be attended with appreciable differences in the development, although not in the organisation, of the animal; and that these differences will be represented in, and will modify the form of the shell. And to such a cause, perhaps, may be attributable the distinction, trivial as it is, which, as we have seen, exists between the shell of the living *H. labyrinthica* and those of its Eocene representatives.

The identity in question exhibits an instance of a terrestrial species surviving important geological changes, and prolonging its existence through geological epochs of very great extent, but to the probable duration of which no approximation even can be made and yet preserving its normal form almost without modification; an instance unparalleled, if, as will probably prove to be the case, the various forms of Terebratula referred to the recent *T. caput-serpentis* belong to different species.

Brogniart, ('Ann. du Muséum d'Histoire Naturelle,' tom. xv, p. 380,) has described a small trochiform Helix from the neighbourhood of Mans (*H. Menardi*), which, in the general character of its lineation, resembles this species. It is, however, larger; and the whorls, although described as being "nearly equal," appear, from the figure given, to enlarge more rapidly. The aperture is neither described nor represented, and it is impossible, therefore, to form any opinion as to the identity of the shell with the present species.

*Size.*—Diameter, 1-10th in.; elevation 1-10th in.

*Localities.*—Hordwell Cliff; Headon Hill.

### No. 21. HELIX SUB-LABYRINTHICA. *F. E. Edwards.* Tab. XI, fig. 4 *a—c.*

*H. testâ minimâ, globoso-conicâ, umbilicatâ; spirâ elevatâ, apice obtuso: anfractibus sex, rotundato-convexis, gradatim majoribus, transversim lineatis: aperturâ, obliqua, semilunari, simplici* (?)*; umbilico parvo.*

I possess only one specimen, and that merely a cast, of this small and very rare Helix. Although more pupiform than *H. labyrinthica*, it approaches so nearly to that shell that I feel great hesitation in referring it to a distinct species; on examination, however, differences appear which scarcely justify my describing the shell as merely a variety.

It is a small, globosely conical shell, with an obtuse apex, and formed of six roundedly convex whorls, increasing in size very slowly. The impression of the whorls in the matrix presents a faint lineation, too regular to be due to lines of growth merely. The aperture is oblique and semilunar, but is too imperfect to enable me to say whether the peristome was or was not thickened or reflected. On the outer lip of the penultimate whorl are two linear impressions similar to those produced by lamelliform teeth, to the presence of which they may, perhaps, be attributed; but they are not continued towards, and do not appear at, the aperture. The columellar lip does not present any evidence of teeth. The umbilicus is rather small.

On comparing this shell with *H. labyrinthica,* the distinctions appear to be that, in the present species, the apex is more obtuse, approaching, in that character, more nearly to the recent specimens of that species; the whorls enlarge more slowly, are more roundedly convex, and but slightly, if at all, flattened on the base; the aperture, partaking of the character of the whorls, is rounder, and the teeth, if present, are on the outer lip, and not on the columellar lip, as in *H. labyrinthica;* the umbilicus is smaller, and, if the shell were preserved, would, I think, be nearly closed.

Having only seen the single specimen in my collection, I propose the species with hesitation, although the characters seem to me sufficient for specific distinction.

*Size.*—Elevation 1-10th in. nearly; diameter 1-10th in., nearly.

*Locality.*—Headon Hill.

### No. 22. HELIX HEADONENSIS. *F. E. Edwards.* Tab. XI, fig. 5 *a—d.*

*H. testâ minutâ, orbiculari, sub-depressâ, umbilicatâ; spirâ prominulâ; anfractibus sex, rotundatis, suturis perspicuis: aperturâ rotundato-semi-lunari, obliquâ; peristomate incrassato, reflexo; margine externo tribus lamellis, penitissime decurrentibus, instructo: umbilico lato, profundo.*

A very small depressedly orbicular shell, with a somewhat elevated spire, composed of six or seven rounded whorls, separated by a deep suture; the rounded aperture is oblique, and impinged upon by the body whorl, which gives to it a semilunar shape; the peristome is slightly thickened internally, and reflected; and the outer lip is furnished with three lamelliform teeth, extending far back into the whorls; the umbilicus is wide and deep.

The *H. Headonensis* is apparently extremely rare; my specimen, which I believe to be unique, is merely a cast, and the outward condition of the shell is not shown. The species presents some analogy with the depressed variety of *H. labyrinthica;* but the greater number of the whorls, and the different dentition of the aperture, distinguish it from that shell. In general appearance it resembles the recent *H. pulchella;* but the spire is more elevated, the whorls more numerous, and, in the latter species, the aperture is without the plaits which characterise the present shell. The species appears to be well marked and perfectly distinct.

*Size.*—Elevation rather more than 1-20th in.; diameter 1-10th in.

*Locality.*—Headon Hill.

### Genus 7th. Bulimus.* *Scopoli*, 1786.

Bulimus, *Brug.*, 1792; *Lam.*, 1801.
Cochlea, *Adanson*, 1757.
Cochlostyla, *Férussac*.

*Gen. Char.*—Shell oval, oblong, or turriculated, smooth, or longitudinally striated; spire obtuse, variable in length and in the number of the whorls, which are generally few, and for the most part sinistral; aperture entire, oval, rounded anteriorly; outer lip simple, generally reflected and confluent with the columella; inner lip reflected over the body whorl; columella smooth.

This genus, originally proposed by Scopoli, was adopted by Bruguière, and extended so as to comprise animals essentially different in their organisation; many genera have, in consequence, been since separated from it by Draparnaud, Lamarck, and others. The animal closely resembles that of *Helix;* but M. Deshayes states that it presents a modification of the organs of generation sufficient for generic distinction. The shells may be known from the *Helices* by their more elongated spiral form; from the *Limnææ* by the smooth columella, and from *Pupa* by the more regularly tapering spire.

The genus contains very many living species distributed over the equatorial, tropical, and warm temperate regions, as well of the new, as of the old, world. According to Mr. Lovell Reeve† the localities of nearly 600 species have been ascertained; and of these, three fifths inhabit the western hemisphere, principally central America; and a large proportion, rather more than one third, of the remaining species is found in the Phillippine Islands.

Several fossil species, from the Freshwater deposits of the Paris Basin, have been described by MM. Brard, Brogniart, Lamarck, Defrance, Matheron, and Deshayes; and two distinct species (*B. ellipticus*, Sow., and *B. politus*, nov. spec.,) occur in the contemporaneous deposits in England. The shell described by Mr. Sowerby ('Min. Con.,' vol. iv, p. 89 bis, t. 366), as *B. costellatus*, is an Achatina. Two of the French Eocene species have been found, mixed with marine remains, in the Faluns of Touraine; but, as yet, no species has been found below the Eocene formations.

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* The etymology of this word is not ascertained. Adanson in 1757, in his 'Histoire Naturelle du Sénégal,' applied the name *Bulinus* to a species of the shells which afterwards formed part of Drapernaud's genus *Physa*, but which have since been separated by Dr. Leach, under the generic name *Aplexus;* and the writer of the article "Limneans," in the 'Penny Cyclopædia,' suggests, and apparently with much probability, that the word Buli*m*us was used by mistake by Scopoli and Bruguière for Buli*n*us. Studer seems to consider Bulimus to have been intentionally substituted for Bulinus, and says that the alteration is altogether inadmissible; and Hartmannn and Mr. Broderip concur in rejecting the name. Herrmansen fancifully derives the word from *βουλιμος*, *ingens fames*, in allusion, I presume, to the voracity of the animal. The name Buli*m*us, however, whatever may be its origin or meaning, appears to be generally adopted, and I have therefore retained it.

† Mr. Lovell Reeve, "On the Geographical Distribution of the Bulimi," &c., 'Ann. and Mag. of Nat. Hist.,' 2d ser., vol. vii, p. 241.

### No. 23. BULIMUS ELLIPTICUS. *Sowerby*. Tab. XI, fig. 2 *a—f*.

BULIMUS ELLIPTICUS. *Sowerby*. 1822. Min. Con., vol. iv, p. 46, t, 337.
— TENUISTRIATUS. *G. Sowerby, jun.*, 1846. Lond. Geol. Journal, vol. i, p. 20.

*B. testâ sinistrorsâ, ovali, elongatâ; apice obtuso: anfractibus plano-convexis, superné sub-canaliculatis; transversim lineatis; lineis obliquis, irregularibus, plus minus-ve numerosis; aperturâ sub-auriformi, peristomate simplici, margine columellari reflexo.*

A sinistral, cylindrically-conical shell, with an apex more or less obtuse in different individuals; the whorls are slightly convex, depressed at the upper margin so as to form an obscure channel running parallel with the suture, and covered with numerous transverse raised lines, which are rounded, oblique, and vary considerably in number, frequently in the same specimen. The aperture is oblong and ovate; the sharp outer margin is slightly reflected where it joins the columella, and is frequently thickened as it spreads over the body-whorl.

Fig. 2*f* is taken from a specimen belonging to Mr. Wetherell, found in the excavations in the London Clay at Primrose Hill for the London and Birmingham Railway. The lineation of this fragment is fainter and more crowded, and the whorls appear to be more angular at the base than in *B. ellipticus;* these distinctions induced Mr. G. Sowerby to refer the shell to a distinct species. The faintness of the transverse lines is, however, due to the worn state of the shell, which has apparently lost the outer layer; and their number is a character too uncertain to be relied upon. The specimen represented by fig. 2 *a*, from Mr. D'Urban's collection, shows on one side of the penultimate whorl, lines nearly as crowded as those on the Highgate specimen, while those on the opposite side of the same whorl are moderately distant; and I have in my own collection a specimen, beautifully preserved, in which the same discrepancy occurs. The angularity of the whorls is a character frequently found in shells in an early stage of their growth, and I have several young shells of this species, in which the whorls present a clearly defined angle running round the basal periphery. On these grounds I have referred the specimen in question to the present species.

A form occurs at Binsted, near Ryde, in which the whorls are flatter than in ordinary specimens, and sub-turrited; in other respects it agrees with this shell, of which, therefore, I consider it to be only a variety.

*Size.*—The specimens ordinarily found rarely exceed 2½ inches in length by 9-10ths of an inch in diameter; one specimen, however, in my collection is above 3 inches long, and rather more than 1 inch and 2-10ths in diameter; and the shell from which fig. 2 *c* is taken, forming part of the valuable collection of the late Mr. Dixon now in the British Museum, must have exceeded even those dimensions.

*Localities.*—Shalcombe, Binstead, Sconce, in the Isle of Wight.

### No. 24. BULIMUS POLITUS. . . Tab. XI, fig. 1 *a—d.*

*B. testá conicá, lævissimá, politá; apice deciduo; anfractibus sub-convexis; aperturá ob-ovali, anticé effusá, postice sub-angulatá, peristomate incrassato, reflexo.*

The occurrence of this shell in the fluvio-marine deposit in Headon Hill in such abundance as almost to be inconsistent with the supposition that it is a land shell, suggests that it might be placed with those Paludinæ, in which the margins of the aperture are thickened or reflected, and of which an instance (*Paludina Chastellii,* Nyst,) occurs in a similar formation in Hampstead Cliff. The aperture, however, and the smoothness of the surface, place it, perhaps, more correctly in the present genus, although the latter character is frequently shown in well-preserved specimens of Paludina found in a somewhat similar matrix.

The shell is conical, with a smooth polished surface, on which faint lines of growth are barely perceptible; the apex is subject to decollation, leaving about four convex whorls; the last of which, somewhat like that of *Nematura,* is slightly contracted near the aperture, which is rounded and very effuse in front, and angulated behind; the peristome is thickened and reflected. The length of the aperture is about 2-5ths of that of the whole shell.

The specific name is one by which the shell is generally known. I do not know by whom it was imposed, but it well describes the smooth and polished appearance of the shell, and I have therefore retained it.

*Size.*—Elevation 2-10ths of an inch; Diameter 1-10th in.

*Locality.*—Headon Hill.

## Genus 8th. ACHATINA.* *Lamarck.*

### COCHLITOMA, *Férussac.*

*Gen. Char.*—Shell oval or oblong, subturreted, with an elevated spire; generally smooth, but sometimes longitudinally striated: aperture oval or pyriform, generally greater in length than in width; outer lip thin, never thickened or reflected; columella smooth, inflected and truncated at its base, forming a slight notch where it joins the outer lip.

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* Etym., Diminutive of Αγαθος, beautiful; or of Αχατης, an agate.

The third division made by Bruguière in his genus *Bulimus*, consisting of those species in which the columella is truncated at the base, was formed by Lamarck into the present genus. From this Montfort withdrew his genera *Liguus*, (*Chersina*, Humph.,) consisting of the conical forms in which the aperture is short and nearly round; and *Polyphemus*, comprising the oblong sub-turreted species, with an undulating outer lip, to which Bolten had already given the name *Oleacina*, and which forms the genus *Glandina* of Schumacher and Say, and the sub-genus *Cochlicopa* of Férussac.

As some of the Bulimi present a sharp outer lip, the truncation of the columella appears to be the only character by which the Achatinæ can be separated from that genus, and the value of this character must depend on its being the result of some peculiarity of generic importance in the organisation of the animal. M. De Blainville states that he has observed in the animal of *Achatina zebra* an interruption in the collar where the two sides unite, as if caused by the exsertion (saillie) of the columellar muscle, and to this he attributes the truncation of the columella; but, according to Férussac, this truncation is not the result of any peculiar organisation, as is the case in other molluscous animals, the columella of whose shells present this character; and that author therefore unites the Achatinæ to his genus Helix, of which they form the sub-genus Cochlitoma; and M. Deshayes, on account of the similarity of organisation presented by the animals of Bulimus and Achatina, proposes to re-unite Achatina with Bulimus. The genus, however, is very generally adopted as well by English as by foreign Malacologists, and I have therefore retained it.

The subdivisions proposed by Bolten and Montfort depend on the proportions and other characters in the shell, of trifling importance, which are generally considered as insufficient for generic distinction, however useful they may be for the division of a genus into sections. The recent species *A. glans*, and the cognate species which form the genus *Glandina*, are confined to the West Indian Islands, and the adjacent parts of the American Continent; and the peculiar form of the outer lip may be used with convenience, as one of the indications of the limits of geographical distribution of species.

The Achatinæ are generally large shells; some, in fact, attain a greater size than any other land shells at present known, and many are covered with an epidermis. Although generally dextral, they are in some species constantly sinistral. They are found chiefly in tropical climates, and, according to Blainville, in marshy lands. Some few are European, but only one or two small species occur in England. One fossil species (*A. pellucida*) has been described by M. Deshayes from Parnes; and Bouillett, in his catalogue of the fossil shells of Auvergne, has given another species, which he refers to the recent *A. acicula* (Lamarck).

### No. 25. ACHATINA COSTELLATA. *Sowerby.* Tab. XII, fig. 1 *a—k.*

BULIMUS COSTELLATUS. *Sow.* Min. Con., vol. iv, p. 89 bis, t. 336.
LIMNEA MAXIMA. *Sow.* Ib., vol. vi, p. 53, t. 528, fig. 1.
BULIMUS COSTELLATUS. *Morris.* Cat. of Brit. Foss., p. 140.
LIMNÆUS MAXIMUS. *Morris.* Ib., p. 148.

*A. testâ ovato-oblongâ, apice sub-acuto; anfractibus sex convexiusculis, longitudinaliter costellatis, ad suturam adpressis et irregulariter sub-crenulatis; costellis parum obliquis, irregularibus: aperturâ pyriformi, dimidium totius testæ in longitudinem ferè æquanti, margine externo undato.*

*Var.* ABBREVIATA. Fig. 1 *i—k. A. testâ ventricosiori, breviori; anfractibus quinque, convexioribus; aperturâ longiori, spiram in longitudinem superanti.*

Shell oval-oblong, with a somewhat acute apex; the six volutions, of which the spire is formed, are more or less convex in different individuals, and are longitudinally ribbed; the edges are slightly pressed against the preceding volution, so as to present a narrow band running round the spire, parallel with the suture; the ribs are rounded, irregular, rather oblique, and slightly thickened above the sutural band, giving a rough crenulated appearance to the edges of the volutions; they are crossed, saltierwise, by very faint obscure lines of growth, perceptible only in well-preserved specimens. The aperture is pear-shaped, and about half as long as the entire shell; the outer lip undulated. The truncation of the columella, a character which the imperfect state of the specimens figured by Mr. Sowerby did not enable him to detect, places the shells, described by that author as *Limnea maxima* and *Bulimus costellatus,* in the present genus. The volutions are variable, being in some specimens less convex than in others; and the aperture in the young state is comparatively longer than that of the mature shell. A similar change in the relative proportions of the spire and the aperture at different stages of growth is not of infrequent occurrence, and is exhibited in some of the recent species in this genus, particularly in *Achat. striata,* (*Glandina truncata,* Pfeiffer.) These considerations, confirmed by the examination of a long series of shells of the present species in different stages of growth, have induced me to consider *Bul. costellatus* as merely the young form of the shell figured as *Limnea maxima.* The more regularly conical form of the spire, the only distinction by which the former is separable from the latter, is mainly due to the preservation of the shell in the specimen figured, and is a character which cannot be relied upon.

The present species belongs to the group constituting the genus *Glandina,* and is another instance of the approximation of an European Eocene land Mollusc to the living forms of the Western world.

*Size.*—Axis 2¼ inches, nearly; diameter 9-10ths of an inch.

The specimen represented by figs. 1 *i* and 1 *k,* resembles the type in the crenulated edges, and costellation of the volutions, in the shape of the aperture, and in the character of the columella; and I consider it, therefore, as merely a variety. It is a ventricose shell, with a shorter spire, and more convex whorls; the aperture is longer in proportion, exceeding the spire in length, owing probably to the shell not having attained maturity. The specimen, the only one I have seen, belongs to Mr. D'Urban's collection.

*Size.*—Axis 1 inch and 6-10ths; diameter, 1 inch, nearly.

*Localities.*—Sconce, Shalcombe, Binstead, Isle of Wight.

### Genus 9th. PUPA.* *Lamarck.* 1801.

COCHLODONTA, (sp.), *Férussac.*
COCHLODINA, (sp.), *Férussac.*
COCHLOGENA, (sp.), *Férussac.*

*Gen. Char.*—Shell cylindrical, elongated, or sub-globose; apex generally obtuse, sometimes acuminated; whorls numerous, slowly increasing, the last smaller than the penultimate one; frequently striated or ribbed; aperture generally elliptical, sometimes sub-quadrate in front, and rounded behind; peritreme continuous, slightly incrassated and reflected; outer lip dentated; teeth variable in number; one or two plaits on the columella.

The present genus is one of the dismemberments effected by Lamarck of Bruguière's genus Helix. The organisation of the animal bears a strong general resemblance to that of the animals of *Helix* and *Bulimus;* and Férussac has reunited the genus to Helix, in which it is distributed among the sub-genera Cochlodonta, Cochlodina, and Cochlogena. The shell, however, prevents striking dissimilarities, and in the animal, according to M. Deshayes, the same modifications of the generative organs occur which distinguish the animal of *Bulimus*. The elongated cylindrical form of the spire, the proportion of the last whorl to the penultimate one, and the direction of the aperture which is parallel with the axis, distinguish the shell from *Helix;* and it is separated from *Bulimus* by the numerous and slowly increasing volutions, and by the teeth and folds with which the outer lip and the columella are furnished. It is to *Clausilia* that it bears the closest resemblance; but from that genus it is separated as well by the aperture as by the absence of the clausium, a character which, however, can seldom be available to the Palæontologist.

In the animals of several of the smaller species the peduncles only exist, the tentacles becoming obsolete. Some of these species are sinistral and hyaline, and form Müller's genus *Vertigo*. The animal, however, exactly resembles *Pupa* in everything but the absence of the tentacles, and, inasmuch as their disappearance is very gradual in the smaller species, M. Deshayes attributes but trifling value to that character, and proposes to suppress the genus altogether.

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* Etym., from a supposed resemblance to the Pupa or Chrysalis of some insects.

The living species are very numerous and widely disseminated, but the larger ones are confined apparently to tropical climates.

The fossil species are few; one species (*Pupa Defrancii*) is described by Brogniart from the Freshwater deposits of the Paris basin. Bouillet, in his catalogue of the fossil shells of Auvergne, gives two others referred to recent species; and Matheron describes two more species from the South of France, one from the Freshwater formation at Baux, and the other from the middle beds of the lignite formation near Rognac.

### No. 26. Pupa perdentata. *F. E. Edwards.* Tab. XI, fig. 7 *a—e.*

*P. testâ cylindricâ; apice . . ? anfractibus planulatis, longitudinaliter costellatis, ad basin sub-angulatis; costellis acutis, numerosis, irregularibus, undulosis, parum obliquis; aperturâ sub-quadratâ, multis lamellis inequalibus, penitissimè decurrentibus, utroque margine instructâ.*

The imperfect state of my specimens, which are merely casts, will not enable me to do much more than to record the existence of this well-marked species. The dentition they present rather belongs to *Clausilia* than to *Pupa;* but as this is a dextral shell, and all the known *Clausiliæ* are sinistral, I refer it to the present genus. I possess six or seven specimens only, all without the apex, and the largest showing only the last three whorls. The characters, so far as they can be given from these fragments, are as follows:—Shell cylindrical, apparently elongated, and composed of many whorls; the whorls nearly straight, longitudinally costellated, and bluntly angulated at the base; the costellæ sharp, oblique, numerous, irregular, undulating, and separated by deep rounded sulci, and here and there one of them terminates abruptly, being cut short by the confluence of the sulci. The aperture, owing to the angular base of the body-whorl, assumes a subquadrate, or rather a lozenge shape; the outer lip presents no less than fourteen lamelliform teeth, six of which are large, having smaller teeth between them; the columellar lip is armed with three large lamelliform teeth, and four smaller. These teeth are not merely marginal, as is usually the case in this genus, but are continued, like those of *Clausilia,* far back into the whorls.

*Size.*—Axis . . ? diameter, 2-10ths of an inch nearly.

*Locality.*—Sconce, where it is very rare.

### No. 27. Pupa oryza. *F. E. Edwards.* Tab. XIV, fig. 3 *a—b.*

*P. testâ parvâ, ovato-cylindraceâ, ad utramque extremitatem equaliter attenuatâ; apice sub-obtuso; anfractibus octonis, convexiusculis, longitudinaliter tenuissime costellatis; suturis profundis; aperturâ ovato-oblongâ, angustâ, obliquâ, quaternis dentibus magnis instructâ.*

A small cylindrical oval shell, tapering equally towards both extremities; the apex is rather blunt; the whorls, which are eight in number, are slightly convex, separated by a deep conspicuous suture, and transversely costellated; the costellæ are numerous, very slender, and oblique. The aperture is ovate-oblong, narrow, and somewhat oblique; the outer lip is furnished with four prominent lamelliform teeth, of which the two anterior are the longest.

I possess only one specimen, a cast, of this species; and the state of the aperture does not enable me to say whether the columellar lip is furnished with teeth. The species appears to be perfectly distinct.

*Size.*—Axis 2 lines; diameter 1 line.

*Locality.*—Headon Hill.

## Genus 10th. Clausilia.* *Draparnaud.* 1805.

*Gen. Char.*—Shell sinistral, cylindrical, elongated, consisting of numerous volutions, generally transversely striated; rather blunt at the apex, and enlarged towards the middle; aperture irregular, oval; peristome continuous, free, reflected, with several columellar and other tooth-like plaits, and furnished with an appendage, termed the *clausium,* attached to the columella, by which the aperture is partially closed when the animal is withdrawn into the shell.

The clausium, from which the present genus derives its name, answers the purpose of an operculum, with which, however, it presents no further analogy than that it serves to enclose and protect the animal within the shell. It consists of a narrow, flat, and very thin calcareous pedicle attached by the posterior extremity to the columella, and expanding at the opposite end into a linguiform plate, which nearly closes the aperture of the penultimate whorl, a small canal across the anterior part of the aperture being left uncovered, probably for the purpose of respiration. In some species when the outer lip presents teeth, the clausium is notched for their reception. This curious appendage is formed when the animal approaches maturity, probably at the same time with the projected reflected mouth. The pedicle is very flexible, and yields to the slightest pressure, as the animal emerges from the shell, and the clausium is then bent back against, and fits upon, the curved columella, but recovers its former position by the recoil of the pedicle on the removal of the pressure when the animal withdraws itself into the shell. This peculiar appendage was described first by D'Aubenton, and subsequently by Müller; and the group of shells characterised by its presence was formed by Draparnaud into the present genus.*

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* Etym. *Clausium,* (quasi *clausus,* closed, or *claustrum,* a door,) the appendage by means of which the animal is enclosed in the shell.

The animal of *Clausilia*, so far as its organisation is known, resembles that of Pupa, but Lamarck considered that the differences in the form and condition of the aperture to which I have already referred, were in themselves sufficient for generic distinction without reference to the presence of the clausium. On the other hand, Férussac has placed *Clausilia* in his genus *Helix*, where it forms part of his sub-genus *Cochlodina;* and M. Deshayes has been induced, by the resemblance between the external characters of the animals, by the similarity of their habits, and by the gradual passage from the one genus to the other by intermediate species, to propose the union of the two genera. Unless, however, peculiarity of structure or form in the shell is to be altogether disregarded, the presence of so singular an appendage as the *Clausium* must surely be considered as sufficient ground for the separation of this genus.

Nearly two hundred living species, mostly small shells, are known; several are found in this country, but they occur in great profusion in Southern Europe; the larger species belong to tropical climates.

Only three fossil species I believe have as yet been described; viz., *C. antiqua,* from the Freshwater limestone of Ulm; *C. maxima,* from the neighbourhood of Dax, and *C. campanica,* from the Freshwater limestone of Provins, in which the Paleotherian remains occur.

### No. 28. CLAUSILIA STRIATULA. *F. E. Edwards.* Tab. XI, fig. 6 *a—h.*

*Cl. testâ subturritâ, cylindracea, ad utramque extremitatem attenuatâ, transversim lineatâ: anfractibus numerosis, plano-convexis, ultimo ad basin porrecto; aperturâ ovato-pyriformi, obliquâ; peristomate soluto, parum reflexo: lamellis quinque, duobus margine externo, tribus margine columellari, instructo.*

A cylindrical, subturreted shell, attenuated at each extremity; the whorls are very slightly convex, and covered with numerous rather oblique raised lines, separated by broad rounded sulci, occasionally confluent; the last whorl detaches itself, and projects obliquely forward, terminating in an ovate, pyriform aperture, the margins of which are free, and a little reflected. The outer lip presents two unequal plait-like teeth, the smaller one near the middle, the larger one near the posterior angle of the aperture. On the columellar lip are three similar teeth, one, very large, close to the columella.

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* A particular account of the Clausium has been given by Mr. Miller, in the 'Annals of Philosophy,' vol. iii, p. 378; and by Mr. J. E. Gray, in the 'Zoological Journal,' vol. i, p. 212.

I have not been so fortunate as to meet with any specimen having more than fragments of the shell preserved; the description therefore is principally taken from casts. The chief characters presented by them, namely, the large pliciform teeth and the produced aperture, are, however, plainly shown. The specimen represented by figs. 6 *a* and 6 *b* is, I apprehend, the young shell.

*Size.*—My most perfect specimen of the mature shell has apparently lost the upper six or seven whorls; in its present state it presents six whorls only. The length of the axis is 6-10ths of an inch, nearly; the diameter 2-10ths, nearly. In a perfect state it was probably nearly an inch long.

*Locality.*—Sconce, where it is very rare.

### Genus 11th. SUCCINEA.* *Draparnaud.* 1801.

AMPHIBULIMA, *Lamarck*, 1805; *Hartm.*, 1821.
AMPHIBULIMUS, *Montf.*, 1810.
COCHLOHYDRA, *Férus.*, 1819.

*Gen. Char.*—Shell ovate, or ovately conical, rather elongate; volutions few; spire short, pointed; aperture large, entire, longitudinally ovate, oblique; peristome sharp, not thickened nor reflected, and confluent with the columella; inner lip spread over a part of the body whorl; columella smooth, sharp-edged, with an imperforated axis.

This genus, first created by Draparnaud, has been received without question by all Malacologists except Férussac, with whom it forms the sub-genus *Cochlohydra* in his extensive genus *Helix*. The animals, like all others of this family, present a strong general resemblance to the typical *Helix;* but, according to M. Deshayes, they offer modifications of the generative organs, which differ alike from those of *Helix* and of *Bulimus*. Lamarck, in ignorance of Draparnaud's genus, proposed his genus *Amphibulima*, which he afterwards suppressed, adopting the name given by Draparnaud. The shells are distinguished from *Bulimus* by the thin outer lip, and the rapidly enlarging whorls; and from *Limnæa*, to which they more nearly approach in general form, by the columella, which is thin, smooth, and sharp, and destitute of the oblique fold which characterises the columella of the latter genus.

The *Succineæ* are strictly land animals; for, although frequently covered by water and capable of long submersion, they live habitually on land in damp marshy places, near the margins of pools or ditches.

The living species are not numerous, and are found chiefly in temperate climates.

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* Etym., *Succineus*, of amber, *i. e.*, amber-coloured.

The fossil species are very few. Two only have hitherto been described; both from the Pleiocene formations, and both referred to living forms, viz., *S. putris* and *S. oblonga*, from the Mammaliferous Crag, (Wood's 'Crag. Moll.,' p. 5). The latter species is also given by M. Nyst, ('Coq. Foss. de Belg.,' p. 446,) as occurring in the corresponding formation in Belgium.

### No. 29. SUCCINEA IMPERSPICUA. *S. Wood.* Tab. XI, fig. 3 *a—d.*

S. IMPERSPICUA, *S. Wood.* 1847. Lond. Geol. Jour., vol. i, p. 118.

*S. testá ovatá, ventricosá, tenui, lævi; spirá brevissimá, obtusá: anfractibus tribus, convexis, ad suturam sub-depressis: aperturá rotundato-ovatá, sub-verticali, bessem totius testæ in longitudinem superanti.*

This exceedingly rare shell is thin, smooth, ovate, and composed of three ventricose volutions, rather depressed at the suture. The spire is very short and obtuse; the aperture large, nearly vertical, and in length fully equal to two thirds of the whole shell.

I have three specimens only of this shell: two from Hordwell, for which I am indebted to Mr. S. Wood; the third is from Headon Hill.

*Size.*—Axis rather more than 2-10ths of an inch; diameter, 3-10ths of an inch.

## Section β. *Aquatica,* Fleming.

LIMNOPHILA, *Hartm.*
HYGROPHILA, *Féruss.*

## *Family*—LIMNÆIDÆ.

### Genus 12th. LIMNÆA.* *Lamarck.*

BUCCINUM, (sp.,) *Müller,* 1774.
BULIMUS, (sp.,) *Scopoli,* 1777; *Bruguière,* 1792.
LYMNEA, *Lamarck,* 1801; *Risso,* 1826; *Valenc.,* 1833.
LIMNEUS, *Draparnaud,* 1805; *Brogniart,* 1810.
LYMNEUS, *Brard,* 1809; *D'Orb.,* 1841.
LYMNUS, *Montfort,* 1810.
LIMNÆA, *De Férussac,* 1821; *Nillson,* 1822; *Grateloup,* 1838; *Bronn,* 1838.
LIMNÆUS, *Oken,* 1815; *Rossmasler,* 1835; *Turton,* 1831.
STAGNICOLA, *Leach,* 1820.
GULNARIA, *Leach,* 1820.

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* Etym., Λιμναῖος, belonging to, or growing in, pools or marshes.

LYMNÆA, *J. Sowerby*, 1818; *De Blainville*, 1825; *Desmarest.*
LIMNEA, *G. Sowerby*, 1822; *Fleming*, 1828; *G. Sowerby, Jun.*, 1840.
— *Swainson*, 1837.
LEPTOLIMNEA, *Swainson*, 1840.
LYMNOPHYSA, *Fitzinger*, 1833.
LYMNULA, *Rafinesque*, 1819.

*Gen. Char.*—Shell ovate or elongated, frequently turreted, generally thin, smooth; spire always apparent, more or less elevated: volutions convex, somewhat depressed, sometimes ventricose, and rapidly enlarging; aperture large, entire, longitudinal, ovate, with a tortuous columella bearing an oblique fold; peristome sharp edged.

The shells forming this genus, constituted part of the genus *Bulimus* of Scopoli and of Bruguière; they had previously been separated by Müller from the other land and freshwater Molluscs under the generic name *Buccinum*, applied to them by Lister and Geoffroy. In lieu of this name, which has been applied by Linnæus to a group of marine branchiate Molluscs, Lamarck substituted that of *Lymnea*, etymologically Limnæa.

The animal carries on its head two compressed triangular tentacles, enlarged at their bases, at the inner and anterior parts of which the eyes are placed. Like most others of this order, the *Limnææ* are hermaphrodite, and although the union of two individuals is necessary for fecundation, as among the *Helicidæ*, yet impregnation is not mutual, as in that group; but the same animal performs the male and female functions successively with different individuals.

The genus, as at present defined, is composed exclusively of the thick dextral shells, with a fold on the columella, in which the inner lip is not extended over the body whorl; the genus *Amphipeplea*, (Nillson, the MS. genus *Myxas* of Dr. Leach,) having been proposed for the dextral forms with a plaited columella, in which the shell is thin and polished, and the inner lip expanded. The sinistral forms, without the columellar fold, have been separated under the generic names *Physa* (Draparnaud), and *Aplexus* (Fleming), the *Bulinus* of Adanson. The propriety of these subdivisions is questioned by Mr. G. Sowerby in his 'Genera of Shells;' but, besides the conchological differences above mentioned, there are zoological distinctions which are generally admitted as sufficient grounds for retaining them. These are, in *Physa* and *Amphipeplea*, the condition of the mantle, the edge of which is lobed and capable of extension, so as to cover the shell, which thence acquires the polished and shining surface characteristic of those genera; and the form of the tentacles, which are elongated and filiform, and not thick and triangular, as in the present genus. In *Aplexus* the edge of the mantle is, as in *Limnæa*, simple and not extendible over the shell; that genus, therefore, bears the same relation to *Physa* which *Limnæa* bears to *Amphipeplea.**

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* The propriety of these divisions is, to some extent, confirmed by the observations of Mr. W. Thompson, to which I have before referred. That author, speaking of the dentition in the different genera of the Pulmonata, states that "the character of *Limnæus* appears to be to have one small central tubercle, as it were,

The Limnææ are inhabitants of freshwater streams and pools, and occasionally of brackish marshes. The living species are found in all parts of the world, but principally in the temperate zones. In the fossil state, species have been found in the Wealden formations; and they occur in great profusion in the freshwater deposits of the Eocene epoch, and, in greater or less abundance, in nearly all the lacustrine formations above those deposits. In England, as in the Paris basin, the fossil Limnææ occur in very different conditions in the various deposits; in the limestone of the lower formation, called, from the abundance of their remains, the "Limnæan Limestone," specimens with the shell preserved are very rare; generally only the casts are found, the shelly matter having been absorbed. In the upper marls they occur in great profusion, and, although very fragile, usually in a beautiful state of preservation.

It is exceedingly difficult, as both Lamarck and De Blainville have observed, to distinguish the different species; the length of the spire, the contour of the volutions, and the size and shape of the aperture, characters by which species may be separated with tolerable certainty, in other genera, are, in this genus, exceedingly variable, and glide by imperceptible gradations from one extreme to another; so that reliance cannot be implicitly placed on them. The character which appears to exhibit the least variation is the columellar fold, although this also occasionally presents considerable differences in form and condition. By this character, however, the genus may be divided into two groups, one comprising the species in which the fold is flattened; the other consisting of the species in which it is rounded or sub-acute. Each of these groups may, again, be subdivided into two sections, according as the upper parts of the whorls, forming the sides of the spire, are convex or flat. By the use of these artificial distinctions, the separation of the species will be much facilitated.

### Sect. *a*. Columellar fold compressed, generally bipartite.

### No. 30. LIMNÆA CAUDATA. *F. E. Edwards*. Tab. XII, fig. 2 *a—c*.

*L. testâ ovato-acutâ, ventricosâ, lævi: anfractibus numerosis, convexiusculis, ultimo penultimoque rapidè crescentibus: ultimo obsoletè et irregulariter corrugato: spirâ conico-*

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'squeezed up' between two very large lateral ones, each primary lateral having a very large apex internally, with a small external one, while, at the edge, they have altered to one thick prolonged apex projecting inwards, and irregularly lobed on its upper edge. Much the same arrangement prevails in *Amphipeplea*, where, however, the tubercle of the lateral teeth is even still larger in proportion to its plate. *Physa*, again, exhibits a multitude of teeth of a similar form, though different to any that I have seen in other genera." The dentition of *Aplexus* is not described.

*subulatá: aperturá magná, in medio dilatatá, anticè coarctatá, spiram in longitudinem superanti: plicá columellari compressá, proeminenti, valde obliquatá, obscurè sulcatá.*

*Var.* ABBREVIATA; *testá anfractibus septem vel octo; spirá breviori; aperturá longiori.*

Shell ovate-acute, ventricose, smooth, composed of eight or nine convex volutions, of which the first five or six increase slowly, and the last enlarge rapidly; so that the spire assumes a conical awl-like shape, while the body-whorl is very ventricose. The last two volutions frequently present concentric, obscure, irregular corrugations, giving a crumpled appearance to the shell, similar to that which distinguishes the recent *L. stagnalis.* The aperture is large, effuse towards the middle, but contracted at the anterior part, and somewhat larger than the spire. The columellar fold is flat, prominent, rather strongly twisted, and generally obscurely sulcated.

A variety occurs (fig. 2 *c*) in which the shell is more ventricose, the whorls fewer, the spire shorter, and the aperture proportionally larger, equalling two thirds of the whole shell.

The *L. caudata,* in its general appearance and awl-like spire, much resembles *L. stagnalis;* but, in the latter species, the whorls are more convex, the body-whorl more ventricose, the posterior part of the aperture more effuse, and the columellar fold is rounded, smaller, and more oblique. Individuals occasionally occur which, from the small degree of convexity in the whorls would, at the first glance, be referred to *L. fusiformis;* but they may be easily separated by the columellar fold, which, in the latter species, is rounded, and presents a more graceful spiral than that of *L. caudata.*

*Size.*—Axis 2¼ inch, nearly; diameter 1 inch.

*Localities.*—Hordwell Cliff and Headon Hill.

### No. 31. LIMNÆA PYRAMIDALIS. *Desh.* Tab. XIII, figs. 2 *a*—*b*, and 3 *a*—*b*.

LYMNÆA PYRAMIDALIS. *Desh.* 1824—37. Desc. des coq. foss., &c., vol. ii, p. 95, t. 20, figs. 14, 15.
LIMNEA „ *J. Sow.* 1825. Min. Con., vol. vi, p. 54, t. 528, fig. 3.
LIMNÆA „ *Bouill.* 1836. Catal., des coq. foss. de l'Auvergne, p. 124.
LYMNÉE PYRAMIDALE? *Brard.* 1810. Ann. du Mus., vol. xv, p. 407, t. 24, fig. 2.
LYMNEUS PYRAMIDALIS? *Fér.* 1814. Mém. geol., &c., p. 60, No. 3.

*L. testá ovato-acutá, ventricosá, lævi; anfractibus septem vel octo convexis: aperturá magná, anticè dilatatá, spiram in longitudinem superanti; labio parum expanso; columellá marginatá; plicá columellari magná, compressá, obliquá, in medio sub-bipartitá.*

A smooth, ovate-acute, ventricose shell, composed of seven or eight convex whorls, separated by a simple, well-defined, but not deep suture: the aperture, which is fully as long as the spire, is large and effuse; the inner lip but slightly spread over the body-whorl, and the columella presents a margin formed by the thickened inner lip, and bears a prominent oblique fold, obscurely sulcated.

The whorls enlarge more regularly in this species than in *L. caudata*, and the shell, consequently, is more pyramidal in its general form; and the columellar fold is not so prominent nor so much twisted as in that species. From *L. fusiformis* it is distinguished by the greater convexity of the whorls, and the flattened sulcated fold. The rounder whorls, the depression of the upper margin, and the acute fold of *L. cincta*, separate it, as clearly, from that species.

Although M. Deshayes, in his description of *L. pyramidalis*, cites Brard without comment, I feel great difficulty in referring his shell to Brard's *L. pyramidalis*. That shell, judging from the description and figure, is elongated and narrow, and corresponds, as well in the contour and proportion of the whorls and the form of the aperture, as in the character of the depressed columellar fold, with *L. longiscata*, to which species I think it belongs. It certainly appears to differ widely from the ventricose and comparatively short shell described by M. Deshayes, in which the aperture is large and effuse, and the fold prominent.* The English specimens referred to *L. pyramidalis* of M. Deshayes, agree very well with that author's description and figure, but not with Brard's; while, on the other hand, adult specimens of *L. longiscata* frequently occur, which correspond with Brard's *L. pyramidalis*.

The shell represented by fig. 3 *a—b*, for the use of which I am indebted to Mr. Sowerby, is narrower than the type of this species; and the volutions are so flat, and the general shape so fusiform, that, at first sight, it might be referred to *L. fusiformis*. The fold, however, is flattened and sulcated; and I therefore consider it to be merely an aberrant form of *L. pyramidalis*, combining the columellar fold of that species with the flat-sided spire and subfusiform shape of *L. fusiformis*.

*Size.*—Axis 2 inches; diameter, 9-10ths of an inch, nearly.

*Localities.*—Hordwell; Headon Hill; and in France, La Villette, Montmartre, and Vergnols, near Aurillac.

No. 32. LIMNÆA LONGISCATA. *Brard.* Tab. XII, fig. 3 *a—h*.

LYMNÉE EFFILÉE. *Brard.* 1809. Ann. du Mus., vol. xiv, p. 432, t. 27, figs. 15, 16.
— PYRAMIDALE, *Brard* (?) 1810. Ib., vol. xv, p. 407, t. 24, fig. 2.
LIMNEUS LONGISCATUS, *Brogn.* 1810. Ib., p. 372, t. 22, fig. 9.
— — *Brogn.* 1811. Jour. de Phys., &c., vol. 72, p. 421.
LYMNEUS LONGISCATUS, *Fér.* 1814. Mém geol., &c., p. 59, No. 1.
LIMNEA LONGISCATA, *Sow.* 1823. Min. Con., vol. iv, p. 57, t. 343.
LYMNÆA — *Desh.* 1824. Desc. des coq. foss., &c., vol. ii, p. 92, t. 11, figs. 3, 4.
— — *Desh.* 1824. Encycl. Meth. Vers., t. 2, p. 356, No. 1.

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* This want of resemblance between the *L. pyramidalis* of M. Deshayes and that of Brard is noticed by Bouillet in his Catalogue above referred to.

LIMNEA LONGISCATA. *Lyell* and *Murch.* 1829. Mém. sur les dépôts lacustres tert. du Cantal.
LIMNÆA — *Bouill.* 1836. Cat. des coq. foss., &c., p. 157, No. 6.
— — *Gratel.* 1838. Cat. des débris foss., &c., du Bassin de la Gironde, p. 33, No. 100.
LYMNÆA — *Desh.* 1838. Lam. Hist. Nat. &c., 2d edit., vol. viii, p. 422, No. 7.

*L. testá lævi, elongatá, sub-turritá, acuminatá: anfractibus sex aut septem, convexiusculis; suturis sub-depressis: aperturá ovato-acutá, anticè dilatatá, spiram in longitudinem vix æquanti; labro parum expanso; columellá marginatá; plicá columellari latá, compressá, parum eminenti, bipartitá.*

*Var.* DISTORTA; *testá longiori, angustiori, anfractibus plus decurrentibus; aperturá breviori.*

This Limnæa is more abundant, and, although it presents many varieties of form, is, perhaps, better characterised than any other fossil species. It is a smooth, elongated, narrow, subturrited shell, composed of seven or eight convex whorls, somewhat depressed at the suture. The aperture is oval, rather effuse in front, and, in the typical form, is a little shorter than the spire; the inner lip is thick, but does not extend much beyond the aperture. The columellar fold is broad, flat, not very prominent, and widely but not deeply sulcated.

A variety frequently occurs (fig. 3 *e*—*h*), in which the line of the suture runs below the wide part of the whorl, giving an irregular distorted appearance to the shell, and shortening the aperture, the length of which barely equals two fifths of the whole shell.

Although there can be but little doubt that this is the true *Lymnée effilée* of Brard, the columellar fold does not correspond with the description given by M. Deshayes, in which it is represented to be small and rounded; but in the few French specimens which I have had an opportunity of examining, the columellar fold corresponds with that of the English specimens. I presume, therefore, that the form described by M. Deshayes was a modification of the more general form.

The shell figured and described by Brard as *L. pyramidalis*, appears to me, as I have already stated, from its elongated narrow shape, the form of the aperture, and the slight elevation of the fold, to be merely an adult specimen of this species—similar to that represented by fig. 3 *c* and *d*. The "double suture," or "narrow spiral riband," running along the edge of the suture, which Brard mentions as distinguishing *L. pyramidalis*, frequently occurs in this, as well as in other species; it is not, however, a constant character in any, and cannot be relied upon as a specific distinction.

A form occurs, rather plentifully, in Hordwell Cliff, which Mr. Wood ('Lond. Geol. Journ.' vol. i, p. 118,) has referred to *L. strigosa*, (Brogn.) That species, apparently, was proposed from casts or mutilated specimens, and is a questionable one; M. Deshayes, in fact, ('Descr. des Coq. Foss.,' &c. vol. ii, p. 92,) has suggested that it may be merely a variety of *L. longiscata*. The Hordwell shells, like the French, are shorter, and the whorls are more convex; but they present the characteristic fold of the present species, of which I consider them to be, therefore, only a variety.

*Size.*—Axis, 2 inches; diameter, 8-10ths of an inch.

*Localities.*—Hordwell; Headon Hill; Sconce. *French:* Belleville; Saint-Ouen; Fontainebleau; Rochechouart; Veaurs, and Vergnols, near Aurillac; Dax.

### No. 33. LIMNÆA SULCATA. *F. E. Edwards.* Tab. XIV, fig. 4 *a—b.*

*L. testâ ovatâ; anfractibus quinque vel sex, convexiusculis, substriatis; spirâ mediocri, acutâ; aperturâ ovatâ, spiram in longitudinem superanti; margine externo parum obliquo; plicâ columellari compressâ, vix eminenti, profundè sulcatâ.*

An ovate shell, composed of five or six slightly convex whorls on which the lines of growth are very conspicuous, imparting a sub-striated appearance to the surface; the spire moderately elevated and pointed. The aperture is ovate, and rather longer than the spire; the outer lip but slightly oblique, and the columellar fold compressed, not very prominent, and more deeply sulcated than in any other species.

In general appearance this species resembles *L. arenularia;* but it may be distinguished by the flat and deeply sulcated fold.

*Size.*—Axis, rather more than 1 inch; diameter ½ an inch.

*Localities.*—Hordwell; Headon Hill.

### No. 34. LIMNÆA GIBBOSULA. *F. E. Edwards.* Tab. XIV, fig. 8—*c.*

*L. testâ ovatâ, sub-turritâ; spirâ brevi, sub-acutâ; anfractibus sex, gibbosulis, ultimo magno, suturis profundis: aperturâ acuto-semi-ovali, amplâ, basi effusâ, bessem totius testæ in longitudinem superanti; labro reflexo; plicâ columellari parvâ, parum tortuosâ, subcompressâ, obscurè sulcatâ.*

An ovate sub-turreted shell, with a moderately elevated and rather obtuse spire; volutions six, somewhat gibbous, separated by a deep suture, and, in some specimens, flattened round the upper margin; the last volution is proportionally large. The aperture is semi-oval, dilated in front, acute behind, and exceeds in length two thirds of the whole shell; the inner lip is reflected; the columellar fold small, somewhat compressed, not much twisted, and obscurely sulcated.

This species resembles *L. sublata* more than any other; but the shell is larger, the spire not so much elevated, the volutions more equally gibbous, the aperture much longer and more effuse at the base, the fold not so much twisted and the outer lip not so oblique. From *L. tumida* it is separated by the shorter spire and the flat sulcated columella.

*Size.*—Axis, 1 inch and 7-10ths; diameter, 9-10ths of an inch nearly.

*Locality.*—Headon Hill.

### No. 35. LIMNÆA SUBLATA. *F. E. Edwards.* Tab. XIII, fig. 4 *a—b.*

*L. testá ovato-acutá, ventricosá: anfractibus sex, convexis, lævibus; aperturá rotundato-semi-ovali, per-obliquá, amplá, spiram in longitudinem paulo superanti; margine externo reflexiusculo; plicá columellari compressiusculá, angustá, parum eminenti, valde tortuosá.*

A smooth, ventricose shell, with a moderately elevated spire, and an acute apex: the six whorls of which it is formed are convex, and separated by a conspicuous but not deep suture; the aperture is roundedly semi-oval, effuse, and a little longer than the spire. The outer lip is very oblique, and slightly reflected; the inner one scarcely extends beyond the aperture; the columella is much twisted, and the small narrow fold is compressed and very little prominent.

Owing to the great obliquity of the aperture, the shell must have been carried by the animal with the spire more raised than is usually the case in this genus; from this peculiarity the specific name has been taken.

The present species approaches nearly to *L. gibbosula*, but the spire is longer and more pointed, the whorls more ventricose, and the aperture shorter in proportion, and more oblique. The greater convexity of the whorls, the shorter spire, the narrow, slightly projecting fold, and the effuse and oblique aperture, distinguish it from *L. pyramidalis*. It appears to be rare.

*Size.*—Axis 1½ inch; diameter 8-10ths of an inch.

*Locality.*—Headon Hill.

### No. 36. LIMNÆA MIXTA. *F. E. Edwards.* Tab. XIII, fig. 5 *a—b.*

*L. testá ovato-acutá; spirá elevatá; anfractibus sex vel septem, convexiusculis, longitudinaliter striatis, ultimo magno, sub-ventricoso: aperturá ovali, anticè coarctatá, bessem totius testæ in longitudinem ferè æquanti; plicá columellari sub-rectá, angustá, compressiusculá, parum eminenti, obscurè sulcatá.*

An ovate shell, with a moderately elevated pointed spire; volutions six or seven, slightly convex, almost flat on the upper parts composing the sides of the spire, and marked more strongly than usual in this genus by conspicuous irregular lines of growth; the body whorl large and rather ventricose. The aperture is oval, contracted in front, and, in length, nearly equal to two thirds of the whole shell; the columellar fold is very little twisted, narrow, slightly flattened, barely prominent, and obscurely sulcated.

I propose this species with hesitation; it may be only a variety of *L. pyramidalis* or of *L. gibbosula*, but the characters it presents are so mixed, that it is difficult to determine to which species it should be referred. The narrow, flat, and nearly straight fold resembles very closely that of *L. gibbosula;* but the spire is more elevated, more pyramidal, the volutions more regularly convex, and the aperture not so effuse. It is distinguished from the typical *L. pyramidalis*, not only by the columellar fold, which in the latter species is larger, more oblique, and more prominent, but also by the flatness of the sides of the spire, and the greater length of the aperture; and from the variety of that species, by the more contracted aperture. In the character of the spire, and the contracted aperture, it approaches *L. fusiformis;* but it is separated from it by the columellar fold, which in that species is rounded, prominent, and more twisted.

*Size.*—Axis, 1 inch and 6-10ths; diameter, 8-10ths of an inch.

*Locality.*—Headon Hill.

### No. 37. LIMNÆA OVUM? *Brogn.* Tab. XIV, fig. 12 *a—b.*

LIMNEUS OVUM, *Brogn.* 1810. Ann. du Mus., vol. xv, p. 374, tab. 22, fig. 13 A, B.
— — *Brogn.* 1811. Journ. de Phys., &c., p. 422.
LYMNEUS — *Férus.* 1814. Mém. geol., &c., p. 60, No. 6.
LYMNÆA — *Desh.* 1824—37. Desc. des coq. foss., &c., vol. ii, p. 97, tab. 11, figs. 15, 16.
— — *Desh.* Encyc. Méth. Vers., vol. ii, p. 361, No. 16.
— — *Bouill.* 1836. Cat. des coq. foss. d'Auv., p. 131, No. 13.

*L. testá ovali, sub-ventricosá, acuminatá, sub-lævi; anfractibus sex, convexis, ultimo magno: aperturá mediocri, ad basin sub-dilatatá; columellá marginatá; plicá columellari parvá, compressá, sulcatá, anticé angulatá, parum tortuosá.*

As I have not had an opportunity of comparing the English with French specimens of this species, the identification cannot be altogether free from doubt. The English shell is nearly smooth, ovate, and sub-ventricose, with a moderately elevated and pointed spire; volutions six or seven, separated by a conspicuous but not deep suture. The aperture is not wide, but is a little dilated in front, and is about half the length of the entire shell: the columellar fold is small, compressed, obscurely sulcated, very slightly twisted, and scarcely projects into the aperture; the anterior margin presents an acute ridge, formed by the prolongation of the sharp edge of the peristome; the inner lip is slightly reflected.

The aperture is not so contracted in front as M. Deshayes describes that of the French shell to be; it agrees very well with Brogniart's figure, but not with that given by M. Deshayes, although the latter was taken from Brogniart's specimen. In other respects the English shells do not appear to differ from the French.

In the general contour, and in the proportions of the aperture, the present species closely resembles *L. convexa;* but the small, flat, sulcated fold separates it from that species.

*Size.*—Axis, 1 inch and 3-10ths; diameter, rather more than 6-10ths of an inch.

*Localities.*—Headon Hill. *French:* Pierrelaie.

Sect. *b.* Columellar fold rounded or sub-acute.

### No. 38. LIMNÆA FUSIFORMIS. *J. Sowerby.* Tab. XIII, fig. 8 *a—g.*

| | | | |
|---|---|---|---|
| LYMNÆA FUSIFORMIS, | *J. Sow.* | 1818. | Min. Con., vol. ii, p. 155, tab. 169, figs. 2-3. |
| LIMNEA — | *G. Sow.* | | Genera of Shells. |
| — — | *Lyell* and *Murch.* | 1829. | Sur les dépôts lacustres, &c., du Cantal. |

*L. testâ ovato-acutâ, sub-fusiformi, lævi; anfractibus septenis vel octonis, sub-planis, ultimo ventricoso: aperturâ ovatâ, spiram in longitudinem vix æquanti; columellâ marginatâ; plicâ columellari rotundatâ aut sub-acutâ, parum tortuosâ.*

*Var.* DEFORMIS, (fig. 8 *c—e,*) *testâ breviori; anfractibus sex vel septem, ventricosioribus: aperturâ rotundato-ovali, spiram in longitudinem superanti; plicâ columellari rotundatâ, eminentiori.*

A smooth ovate-acute shell, formed of seven or eight whorls, the upper sides of which are nearly straight, giving a regular conical form to the spire, which is elevated and pointed; the last whorl is ventricose; the lines of growth conspicuous and sharp. The aperture is ovate, moderately large, and nearly as long as the spire; occasionally the anterior part is somewhat contracted, imparting a sub-fusiform shape to the shell. The columellar fold is thick, and, generally, rounded; but sometimes it presents a rather sharp anterior margin; it is slightly and gracefully twisted.

Of this species, as of *L. caudata,* a variety occurs (fig. 8 *c—e*) in which the shell is much shorter, the volutions very ventricose, the aperture roundedly ovate, and the fold rounded and prominent.

The contraction of the anterior part of the aperture, causing the fusiform shape to which Mr. Sowerby refers, frequently occurs, but it is not by any means a constant character; in fact, the aperture is more generally somewhat effuse, as represented in the figure 8.

This species approaches *L. pyramidalis* more nearly than any other of the fossil *Limnææ;* but the flatness of the sides of the spire, and the rounded fold, are characters by which it may easily be distinguished. The variety resembles the short variety of *L. caudata;* but the whorls are more ventricose, and the fold is not compressed and sulcated, as in that species.

*Size.*—Axis, 2 inches nearly; diameter, 8-10ths of an inch.

*Localities.*—Hordwell, Headon Hill, Sconce. *French:* Aurillac in the Cantal.

### No. 39. Limnæa tumida. *F. E. Edwards.* Tab. XIII, fig. 6 *a—b.*

*L. testá ovato-acutá, ventricosá, sexies vel septies circumvolutá; spirá elevatá, apice acuminato; anfractibus convexis, ultimo tumido: aperturá ovatá, amplá, bessem totius testæ in longitudinem fere æquanti; margine columellari reflexo; plicá parum tortuosá, eminenti, rotundatá, in medio sub-callosá.*

An ovate, ventricose shell, with an elevated, pointed, rather subulate, spire; volutions six or seven, the early ones increasing in size slowly, the last two more rapidly; the upper parts forming the sides of the spire are rather flattened, as in *L. pyramidalis;* the body whorl large and tumid. The aperture is ovate, and in length nearly equal to two thirds of the whole shell; the anterior margin, where it joins the columella, is slightly reflected; the columella itself is not much twisted, and the fold is prominent, round, and thickened towards the middle.

This species may be distinguished from *L. gibbosula,* by the round columellar fold and longer spire; and from *L. fusiformis,* by the more convex volutions, the tumid body whorl, the longer aperture, and the nearly straight fold.

*Size.*—Axis, 1 inch and 8-10ths nearly; diameter, 11-10ths of an inch.

*Locality.*—Headon Hill.

### No. 40. Limnæa columellaris. *J. Sowerby.* Tab. XIII, fig. 9 *a—b.*

Limnea columellaris, *Sow.* 1826. Min. Con., vol. vi, p. 53, t. 528, fig. 2.
— — ? *Lyell* and *Mur.* 1829. Sur les depôts lacustres, &c., du Cantal.

*L. testá ovato-ventricosá, sub-turritá, quinquies vel sexies circumvolutá; spirá brevi, apice acuto; aperturá ovali, dilatatá, bessem totius testæ in longitudinem fere æquanti; plicá columellari rotundatá, callosá, valde contortá, pro-eminenti.*

I am indebted to Mr. Sowerby for the use of the original specimen described by him of this species. It is a ventricose, oval shell, with a short pointed spire, and formed of five or six very convex whorls, rather depressed at the suture, whence the shell presents a subturreted appearance; the aperture is large, effuse, and nearly as long as two thirds of the whole shell; the thick, callous-like fold is round, very prominent, and much twisted.

If it were not for the convexity of the whorls and the size of the aperture, I should be inclined to consider this shell to be only a variety of *L. fusiformis;* and that the unusual contortion of the fold, a character to which individuals of that species occasionally approach very nearly, is accidental. But in this species, the pyramidal shape, which always distinguishes the spire of *L. fusiformis,* is altogether wanting. From *L. tumida,* which it resembles in the size of the aperture, it is also separated by the greater flatness of the sides of the spire and the less prominent and less oblique fold of that species. It appears to be very scarce.

*Size.*—Axis, rather more than 1 inch; diameter, ½ an inch.

*Locality.* Hordwell. *French:* Aurillac in the Cantal.

### No. 41. LIMNÆA SUB-QUADRATA. *F. E. Edwards.* Tab. XIII, fig. 1 *a—b.*

*L. testâ ovato-oblongâ, turritâ, lævi; spirâ mediocri, apice acuto: anfractibus sex aut septem plano-convexis: aperturâ ovatâ, anticè dilatatâ, spiram in longitudinem superanti; labio incrassato reflexo; columellâ subrectâ, plicâ parvâ, vix eminenti, sub-acutâ.*

Shell ovate, oblong, turreted, smooth, with six or seven rather flatly-convex volutions; spire moderately elevated, with an acute apex; aperture ovate, somewhat effuse in front, and rather more than half the length of the whole shell; the inner lip thickened, and a little reflected; the columella nearly straight, and presenting a small, rather sharp fold, which scarcely projects into the aperture.

The turreted and depressedly convex form of the whorls gives a sub-quadrate appearance to this shell, by which, as well as by its nearly straight columella, and sharp and barely prominent fold, it may be distinguished from *L. convexa,* which it most nearly resembles.

*Size.*—Axis, rather more than 1½ inch; diameter, 8-10ths of an inch.

*Locality.*—Headon Hill.

### No. 42. LIMNÆA CONVEXA. *F. E. Edwards.* Tab. XIII, fig. 7 *a—b.*

*L. testâ ovato-ventricosâ, sexies circumvolutâ; anfractibus convexis, lævibus; spirâ elevatâ, apice sub-acuto: aperturâ ovatâ, anticè effusâ, spiram in longitudinem superanti; labio reflexo; plicâ columellari pro-eminenti, tortuosâ, rotundatâ.*

An ovate ventricose shell, formed of six smooth convex volutions, with a moderately elevated and pointed spire: aperture ovate, effuse in front, and rather longer than the spire; the inner lip slightly reflected; the columellar fold round, prominent, and very oblique.

This species somewhat resembles *L. sub-quadrata;* the whorls, however, are more regularly convex, and do not present the turreted appearance which characterises that shell; and the round columellar fold is much more prominent, and more strongly twisted. In the convexity of the whorls it approaches *L. pyramidalis,* but the flat sulcated fold separates that species from this.

*Size.*—Axis, 1 inch and 3-10ths; diameter, 6-10ths of an inch.

*Locality.*—Headon Hill. In Mr. D'Urban's collection.

### No. 43. LIMNÆA COSTELLATA. *F. E. Edwards.* Tab. XIII, fig. 10 *a—b.*

*L. testâ ovato-ventricosâ, sub-turritâ; spirâ mediocri, acuminatâ; anfractibus quinque vel sex, convexis, longitudinaliter sub-costellatis, et lineis incrementi subtilissimé striatis; costellis obscuris, irregularibus, remotiusculis: aperturâ ovatâ, amplâ, spiram in longitudinem superanti; labio reflexo; plicâ columellari vix tortuosâ, rotundatâ, parum eminenti.*

The striated *Limnææ* generally acquire that character from the conspicuous lines of growth; but the present species presents obscure costellæ, as well as the striation due to the lines of growth. It is an oval, ventricose, sub-turreted shell, with a moderately elevated spire and pointed apex, and formed of five or six convex volutions, very finely striated by the lines of growth, and also longitudinally costellated; the costellæ are obscure, irregular, and separated by broad shallow sulci, in which the lines of growth are perceptible. The aperture is ovate, rather dilated, and a little longer than the spire; the columellar margin strongly reflected, and the fold rounded, slightly twisted, and but little prominent.

Independently of its costellated character, this species presents differences which prevent its being confounded either with *L. strigosa* (Brogn.), or *L. substriata* (Desh.). In the first species, the shell is more elongated, the aperture smaller, and the columellar fold resembles that of *L. longiscata,* of which I think it is merely a variety; in the latter, the spire is more elevated, the aperture much contracted in front, and altogether narrower; and the fold is prominent and strongly twisted.

The present appears to be a well-marked species.

*Size.*—Axis, rather more than 1 inch; diameter, 4-10ths of an inch.

*Localities.*—Hordwell; Headon Hill.

### No. 44. LIMNÆA FABULUM. *Brogniart.* Tab. XIV, fig. 10 *a—b.*

| | |
|---|---|
| LIMNEUS FABULUM. | *Brogn.* 1810. Ann. du Mus., vol. xv, p. 375, t. 22, fig. 16. |
| — — | *Brogn.* 1811. Journ. de Phys., &c. vol. lxxii, p. 423. |
| LYMNEUS — | *Fér.* 1814. Mém. geol., p. 61, No. 13. |
| LIMNEA — | ? *Lyell* and *Murc.* 1829. Sur les depôts lacust. tert. du Cantal. |
| LYMNÆA FABULA. | *Desh.* 1824—37. Desc. des coq. foss., &c., vol. ii, p. 96; t. 11, figs. 11-12. |
| — — | *Desh.* 1830. Ency. Méth. Vers., vol. ii, p. 361. |
| LYMNEUS FABULUM. | *Defr.* 1835. Dict. des Sci. Nat., vol. xxvi, p. 462. |
| LIMNÆA FABULA. | *Nyst.* 1836. Rech. coq. foss. de Hoesselt, &c., p. 20, No. 49. |
| LYMNÆA FABULA. | *Desh.* 1838. 2d edit. Lam. Hist. Nat., vol. viii, p. 223, No. 9. |
| LIMNÆUS FABULA? | *Nyst.* 1843. Desc. des coq. &c. foss. des Terr. tert. de Belg., p. 469, t. 38, fig. 18. |

*L. testâ ovato-ventricosâ, lævi, acuminatâ; anfractibus quinque vel sex, convexiusculis: aperturâ ovato-acutâ; plicâ columellari sub-acutâ, parum tortuosâ.*

A smooth, ovate, ventricose shell, with a short pointed spire, and formed of five or six slightly convex whorls; the aperture pointedly ovate, and the columellar fold somewhat angular and prominent, but not much twisted.

I have not had an opportunity of comparing the English with the French shells, and I have therefore some hesitation in pronouncing as to their identity. My specimens, however, agree very well with the description and figures given by M. Deshayes, (which it must be remembered are taken from casts merely,) except that the French shell is described as formed of four whorls only, and as having the aperture contracted at the base; but the figures show six whorls, and the aperture, as drawn, is scarcely more contracted than that of the English shell.

*Size.*—Axis, rather more than 8-10ths of an inch; diameter, 4-10ths of an inch.

*Localities.*—Hordwell. *French:* Jouy; Saint-Prix, Montmorency; Pierrelaie and Lavergnol in the Cantal. *Belgian:* Kleyn-Spauwen.

### No. 45. LIMNÆA CINCTA. *F. E. Edwards.* Tab. XIV, fig. 5 *a—b.*

*L. testá elongato-ovatá, sub-turritá, sexies vel septies circumvolutá; spirá exsertá, acuminatá; anfractibus convexis, substriatis: aperturá rotundato-ovatá, amplá, spiram in longitudinem æquanti; plicá columellari parvá, angustá, rotundatá, parum tortuosá, proeminenti.*

An elongated ovate shell, with an elevated pointed spire; volutions six or seven, very convex, almost ventricose, the edges of which are depressed along the suture, and, generally, present a sharp stria running round them, parallel with and at a short distance below the suture,—similar to that mentioned by Brard as characterising his *L. pyramidale:* the lines of growth are so strongly marked that the surface of the shell almost appears to be striated. The aperture is roundedly ovate, somewhat effuse, and barely exceeds the spire in length; the columellar fold is narrow, rounded, not much twisted, and prominent.

The line of suture frequently runs below the wide part of the whorl, giving a distorted appearance, resembling that which is sometimes seen in *L. longiscata,* and in fact the present shell presents a close analogy with that species. It is, however, distinguished from *L. longiscata,* as well as from *L. pyramidalis* (Desh.), by the round columellar fold, and the greater convexity of the whorls.

*Size.*—Axis, 1½ inch; diameter, rather more than ½ an inch.

*Locality.*—Headon Hill.

No. 46. **Limnæa angusta.** *F. E. Edwards.* Tab. XIV, fig. 6 *a—b.*

*L. testá angustá, elongatá, sub-turritá, quinquies vel sexies circumvolutá; spirá elevatá, acuminatá; anfractibus convexis, lineis incrementi obscuré striatis: aperturá ovato-oblongá, anticé sub-dilatatá, spiram in longitudinem parum superanti; plicá columellari crassá, tereti, parum eminenti, sub-tortuosá.*

If it were not for the thick, round, columellar fold, and the elongated aperture, I should refer this species to *L. longiscata,* which it much resembles. It is a narrow, elongated, sub-turreted shell, formed of five or six convex volutions, obscurely striated by the lines of growth; the spire elevated and pointed. The aperture is a longish oval, equal to half the length of the shell, and rather spread out in front; the columellar fold is thick, round, not very prominent, and but slightly twisted.

The long narrow shape of this shell separates it from every species except *L. longiscata;* from the latter shell it is easily distinguished by the fold, so opposite in character to the broad, flat, sulcated fold which characterises that species.

*Size.*—Axis, 1¼ inch; diameter, not quite ½ an inch.

*Localities.*—Hordwell; Headon Hill.

No. 47. **Limnæa arenularia.** *Brard.* Tab. XIV, fig. 13 *a—b.*

Lymnée des gres. *Brard.* 1810. Ann. du Mus., vol. xv, p. 409, t. 24, fig. 5-6.
Lymneus arenularius. *Féruss.* 1814. Mém. geol. &c. p. 61, No. 15.
Lymnæa arenularia. *Desh.* 1824—37. Desc. des coq. foss., &c., vol. ii., p. 93, t. 11, figs. 7-8.

*L. testá ovato-acuminatá, sub-turritá, lævi; anfractibus septenis, convexiusculis, suturis conspicuis: aperturá amplá, semi-ovali, spiram in longitudinem superanti; plicá columellari rotundatá, minimá, parum contortá, sub-proeminenti.*

A smooth, ovate, oblong sub-turreted shell, with a moderately elevated and taper spire; volutions seven or eight, slightly convex, separated by a conspicuous, but not deep, suture, and occasionally striated by faint lines of growth: the aperture rather large, semi-oval, a little dilated in front, and longer than the spire; the columellar fold rounded, small, slightly twisted, and not very prominent.

The English shells correspond so nearly with M. Deshayes's figures, and with some French specimens, for which I am indebted to that gentleman, as not to leave any doubt as to this identification, notwithstanding that M. Deshayes describes the aperture as very oblique, and the columellar fold as much twisted, characters which I have not found prominent either in the English or French specimens.

*Size.*—Axis, 4-10ths of an inch; diameter, 7-20ths of an inch.

*Localities.* — Hordwell; Headon Hill. *French:* Beauchamp, near Pointoise, Valmondois.

### No. 48. LIMNÆA MINIMA. *Sowerby.* Tab. XIV, fig. 9 *a—c.*

LYMNÆA MINIMA. *Sow.* 1817. Min. Con. vol. ii, p. 156, t. 169, fig. 1.

*L. testâ minimâ, ovato-elongatâ, lævi; anfractibus quinque aut sex, convexiusculis: aperturâ ovali, spiram in longitudinem vix æquanti; margine columellari reflexo; plicâ sub-rectâ, rotundatâ, parum eminenti.*

It is not unlikely that this, as Mr. Sowerby has suggested, may be the young shell of some species already described, probably of *L. arenularia,* to which, in its regularly taper spire and rounded fold, it presents a close approximation. It is a very small, smooth, elongated, ovate shell, with five or six rather convex volutions, separated by a moderately deep suture: the aperture is ovate, and rather less than half the length of the entire shell; the inner lip is strongly reflected, and the fold is round, nearly straight, and very little prominent.

The figures are taken from the original specimen described by Mr. Sowerby in 'Mineral Conchology.'

*Size.*—Axis, 3-10ths of an inch nearly; diameter, 2-10ths nearly.

*Locality.*—Headon Hill.

### No. 49. LIMNÆA RECTA. *F. E. Edwards.* Tab. XIV, fig. 7 *a—b.*

*L. testâ ovato-ventricosâ, sub-turritâ; spirâ mediocri, apice acuto; anfractibus sex aut septem, convexis: aperturâ ovali, amplâ, anticé dilatatâ, longiori quam spira; margine columellari sub-reflexo; plicâ parvâ, vix tortuosâ, parum eminenti.*

The convexity of the whorls, the pointed spire, and the nearly straight rounded fold, distinguish this from every other fossil species. It is a short ovate shell, with a moderately elevated spire, and an acute apex; volutions six or seven, very convex, the last one rather ventricose: the aperture large, of a roundedly ovate form, effuse in front, and longer than the spire; the inner lip slightly reflected, and the small rounded fold nearly straight, and scarcely impinging upon the aperture.

This shell much resembles *L. ovum* (Brogn.); but the volutions are fewer and more ventricose, and the aperture is more effuse. It does not appear to me to be referable to any other species; and I have therefore, although reluctantly, described it as a distinct species.

*Size.*—Axis, 1 inch and 1-10th; diameter, 5-10ths of an inch.

*Locality.*—Headon Hill.

No. 50. **Limnæa tenuis.** *F. E. Edwards.* Tab. XIV, fig. 11 *a—b.*

*L. testâ tenui, ovato-ventricosâ, sub-turritâ; anfractibus sex, convexis, ultimo magno; apice acuto: aperturâ ovatâ, effusâ, in longitudinem bessem totius testæ ferè æquanti; plicâ columellari brevi, angustâ, rotundatâ, parum tortuosâ.*

This species presents so close an analogy with *L. tumida,* that it would be difficult to separate the two, if it were not for the great difference in size. The shell is very thin, ovate, and formed of six convex volutions, depressed round the suture, which character imparts to it a sub-turreted appearance; the spire is somewhat elevated and pointed; the body-whorl large and ventricose: the aperture ovate, effuse, and nearly as long as two thirds of the entire shell; the columellar fold short, narrow, rounded, and not much twisted.

*Size.*—Axis, 8-10ths of an inch; diameter, 4-10ths of an inch.

*Locality.*—Headon Hill.

## Genus 13th. Planorbis. *Geoffroy.*

Coretus, *Adanson*, 1757.
Planorbis, *Geoffroy*, 1767; *Guettard*, 1770; *Müller*, 1773-4.

*Gen. Char.*—Shell discoidal, spire depressed; volutions apparent above and below, convoluted upon a nearly horizontal plane, thin, generally smooth, ventricose, sometimes carinated: aperture simple, lunate, crescent-shaped or sub-quadrate, impinged upon by the preceding volution; outer lip generally thin, sharp edged, sometimes thickened or reflected; columellar lip slightly spreading over the body whorl. No operculum.

The animals belonging to this genus were placed by Linnæus among the Helices; they had, however, been separated, as a distinct group, by Lister, nearly a century previously, and formed the third section of the Lacustrine shells of that author. Shortly before the publication of the Systema Naturæ, Adanson described a small species to which he gave the generic name Coretus. The genus was afterwards defined by Geoffroy under the present name *Planorbis;* and Müller, to whom it has been generally attributed, only adopted Geoffroy's name.

The animal of *Planorbis* is elongated, slender, and strongly rolled up; the head is furnished with two long contractile tentacles, at the internal bases of which the eyes are placed; the orifices are on the left side; the organs of generation distinct.

Whether the shell of *Planorbis* is dextral or sinistral is a question which has been much discussed, and, by some authors, is considered as still undecided. By Linnæus, Müller, and subsequent writers to the time of Cuvier, it was regarded as dextral, and was described as *supra umbilicata.* The transposition in *P. corneus* of the orifices and the heart, all of which are on the side contrary to that in which they are placed in the animals of dextral shells, induced Cuvier to consider that species as sinistral: and in this opinion many eminent naturalists have concurred. M. Desmoulins, however, has ascertained, by a careful anatomy of the animal of *P. corneus*, that, although the orifices and the heart have an abnormal position, the organs of digestion and generation, in fact, retain the position they hold in dextral molluscs; and that author, therefore, maintains that nearly all the known species of *Planorbis*, as well living as fossil, are dextral. M. Deshayes concurs in this opinion; and, after remarking that the upper side may be distinguished from the under side by the obliquity of the aperture, the superior margin of which is more produced, cites the observations of M. Desmoulins as explaining the apparent anomaly of a sinistral animal in a dextral shell, and how, in reality, the animal is dextral as well as the shell; there not being any other derangement in the relation of its organs than with regard to the heart and the termination of the digestive and generative organs. With regard to the shell, it will be seen at once, on observing the manner in which it is carried by the animal, that it is dextral, and that, as Mr. Benson has stated,* if it be viewed practically as sinistral, and placed as such, the animal will be on its back, and will have to twist its body half round in order to gain the ground with its foot. Mr. Benson, therefore, proposes to consider that face as containing the apex, in discoidal shells, which is contiguous to the back of the animal; and, he adds, this side may invariably be known in *Planorbis* by the greater projection of the lip in that part, by the deeper depression of the central umbilicus, and by the more considerable involutions of the whorls occasioning a greater depth of suture. Mr. G. Sowerby, on the other hand, asserts† that the shell is sinistral, and that it is only needful to observe on which side of the shell the very apex of the spire is actually to be seen, and, taking that side for the upper, in conformity with the strict rules of analogy, it will immediately be evident that the aperture is on the left side. This criterion, however, is seldom available; for, in general, the apex is concealed by the involution of the whorls, and the shell presents, on each face, what may be easily mistaken for an umbilicus; and the difficulty in determining which face contains the apex, and which the true umbilicus, is not removed. It is well known that testaceous molluscs, when placed in conditions unfavorable to healthy development, frequently depart from their normal form; and that their shells, in consequence, are distorted, and become what are usually called monstrosities. Thus, in *Planorbis*, the animal, under such conditions, frequently loses, to a greater or less degree, its strong convolution on a horizontal plane; and the shell assumes, in conformity, a more or less elongated spiral form, with an elevated apex. M. Desmoulins cites these monstrosities in support of his opinion, observing that, when they occur, the whorls gradually glide from left to right, down the imaginary axis. A series of such distorted specimens of *P. complanatus*, taken from a pond near Swansea, formed, I believe, by the waste water from a steam-engine, and of a high temperature, is in the British Museum. These specimens have all assumed an elevated spiral form; and the aperture is in every case dextral. Several specimens of *P. vortex*, in Mr. Sowerby's Museum, are similarly distorted; and in them also the apertures are dextral. On the whole, the better opinion appears to be that the shell, as well as the animal, is dextral, notwithstanding the abnormal position of the heart and the orifices; and in the following descriptions, therefore, I have considered the shell as dextral, and I have applied the term *upper* to that disc which is uppermost when the shell is placed with the mouth on the right side of the spectator, and the term *under* to the opposite disc.

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* Journal Asiat. Soc. Bengal, vol. v, p. 744.

† Genera of Shells. Gen. *Planorbis*.

The *Planorbes* live in fresh water; more frequently in stagnant water or standing pools, although, occasionally, they are found in gentle streams. They are widely diffused, but abound principally in temperate climates. I believe that at present there is not any species known as living in salt or brackish waters; and the specimens found in the crag formation, and described by Mr. Wood, are referred to recent species which are known to be pure fresh-water animals; and these shells are therefore considered to have been accidentally introduced.

Four species also occur in the estuarine or fluvio-marine deposits of the Eocene epoch: viz., *P. hemistoma* (Sow.); *P. obtusus* (Sow.); *P. biangulatus* (nov. spec.); and *P. elegans* (nov. spec.); but, like the crag specimens, they have, probably, been deposited there by the agency of some river: they all occur in the pure fresh-water or the transition formations.

Fossil species are numerous, but they abound principally in the formations of the tertiary epoch; Prof. E. Forbes, however, states, (Brit. Mol., vol. iii, p. 146,) that representatives of the genus, differing but slightly from species still living, are found in fresh-water strata of even the oolitic epoch.

### No. 51. PLANORBIS EUOMPHALUS. *Sowerby.* Tab. XV, fig. 6 *a—c.*

PLANORBIS EUOMPHALUS. *J. Sowerby.* Min. Con., vol. ii, p. 92, t. 140, figs. 7—9.
— — *G. Sowerby.* Genera of Shells, fig. 5.
— — *Deshayes.* Lam. Hist. Nat., 2d edit., vol. viii, p. 397, No. 9.

*P. testá supra sub-planá, ad peripheriam angulatá, subtus latè et profundè cavatá; anfractibus sex, sub-trigonis, vix involventibus, transversim lineis incrementi notatis, aliquandoque concentricè striatis; subtûs ad marginem umbilicalem obtusè angulatis; striis concentricis numerosis, irregularibus: aperturá per-obliquá.*

This well-known species, which at present appears to be confined to the fresh-water formations of England, is easily distinguished from the other fossil *Planorbes*. It is a large discoidal shell, nearly flat on the upper face, and presenting a wide and deep umbilical cavity beneath; the six or seven volutions of which the shell is formed, are flat, or nearly so, above; convex below; and each but slightly embracing the preceding volution; the apex is concealed by the involution of the whorls. A clearly defined and rather acute angle, almost forming a keel, runs round the periphery of the shell, and separates the upper from the under disc. This angle is always very conspicuous in young shells; but as they approach maturity, it becomes more and more obtuse, and frequently altogether disappears; the whorls then assume a transversely oval form, approaching nearly to that presented by *P. rotundatus*. On the under surface, the inner margins of the whorls are bent rather suddenly towards the preceding whorl, and present, in consequence, an obtuse angle, which runs round and defines the umbilicus. Transverse lines of growth are very conspicuous; and frequently the surface of the shell also presents more or less numerous concentric raised lines, some of which are larger and more prominent than the rest. The aperture is sub-trigonal, slightly impinged upon by the preceding volution, and very oblique.

This species presents a general resemblance to *P. rotundatus;* but, even when the characteristic angle has become obsolete, it may easily be distinguished by the greater breadth, and the flatness of the upper surfaces, of the whorls, the much larger concavity on the under side of the shell, and the subtrigonal and more oblique aperture. From *P. discus* it is separated by the more compressed form of that species, caused by the greater width of the whorls, and the comparative flatness of their under sides; and in that species the whorls are more embracing than in this.

*Size.*—Diameter, 1 inch and 6-10ths.

*Localities.*—Headon Hill; Hordwell.

### No. 52. Planorbis rotundatus. *Brard.* Tab. XV, fig. 4 *a—c*.

Planorbe arrondi. *Brard.* 1809. Ann. du Mus., vol. xiv, p. 433, t. 27, figs. 19, 20.
Planorbis rotundatus, *Brogn.* 1810. Ib., vol. xv, p. 370, t. 22, figs. 4, 5.
— — *Ib.* 1811. Jour. de Phys., vol. lxxii, p. 419, figs. 4, 5.
— similis. *Fér.* 1814. Mém. geol., p. 61, No. 1.
— rotundatus. *Fér.* 1814. Ib., No. 2, var. a.
— — *Desh.* 1824—37. Desc. des coq. foss., vol. i, p. 83, t. 9, figs. 7, 8.
— — *Desh.* 1824—37. Encycl. Meth. Vers., &c., vol. iii, p. 778, No. 2.
— — *Bowd.* Elem. of Conch., t. iv, fig. 7.
— — *Lyell and Mur.* 1829. Sur les dépôts, &c. du Cantal.
— — *Bouillet.* Desc. hist. et scient. de la Haute Auver., p. 18, figs. 6, 7.
— — *Ib.* 1836. Cat. des coq. viv. et foss. de l'Auver., p. 115, No. 2.
— — *Gratel.* 1838. Cat. des deb. foss., &c., du bassin de la Gironde, p. 33, No. 102.
— — *Desh.* 1838. Lam. Hist. Nat., 2d edit., vol. viii, p. 394, No. 1.

*P. testâ lævi sub-striatâve, supernè sub-planâ, subtus concavâ; anfractibus sex vel septem, rotundatis, vix involventibus, infernè ad marginem umbilicalem sub-angulatis; suturis profundis: aperturâ parum obliquâ.*

A rather large shell, formed of six or seven nearly round volutions, separated by a deep suture, and each slightly impinged upon by the preceding one; the volutions are flatly convex on the upper sides, convex beneath, and, like those of *P. euomphalus*, present an angle running round the inner margins near the umbilicus, which, as the shell approaches maturity, becomes almost obsolete. The upper face is nearly flat; while the under side presents a moderately deep and wide concavity. The aperture is transversely oval, and but slightly oblique. The striæ of growth are very conspicuous; and occasionally, although very rarely, the shells present fine concentric lines, similar to those which characterise *P. euomphalus;* in this species, however, the lines are finer and more crowded, and seldom extend beyond the first three or four volutions.

Brard states that, in *P. arrondi*, the whorls are perfectly round, and do not impinge upon the succeeding whorls; and in these respects his shell does not agree with the English specimens; but the figures, apparently, are taken from a cast, and the disagreement may probably be attributed to that circumstance. Brogniart's fig. 4, (var. A, of that author,) agrees very well with our specimens, except that the aperture is more oblique. In the figure given by M. Deshayes, the whorls are wider and more flattened on the upper surface, and the upper margin of the aperture appears to be more produced than in any English specimen I have seen; the shell, too, is larger than our shells, and, in fact, strongly resembles those specimens of *P. euomphalus* in which the characteristic angle round the whorls has become obsolete.

The general resemblance and the distinctions between the present species and the recent *P. corneus*, have been pointed out by the French authors cited; and, on comparing the two, it will be seen that in the latter species the whorls are fewer, rounder, and enlarge more rapidly, and that in consequence, the shell is deeper and more largely umbilicated than the fossil species.

MM. Férussac and Deshayes mention a variety (probably the var. B of Brogniart) in which the shell is smaller, rather more compressed, and nearly equally concave above and below; I have not met with this variety among the English specimens.

*Size.*—Diameter, 1 inch and 2-10ths.

*Localities.—English:* Sconce; Headon Hill; Hordwell. *French:* Aurillac, La Vissiere, Lavergnol, in the Cantal; Saint-Prix; Palaiseau, Milon near Versailles; Triel; Fontainbleau; La Villette.

### No. 53. PLANORBIS OBTUSUS. *Sowerby.* Tab. XV, fig. 1 *a—e.*

PLANORBIS OBTUSUS. *Sow.* 1818. Min. Con., vol. ii, p. 91, t. 110, fig. 3.

*P. testâ depressâ, lævi; supernè convexiusculâ, subtûs concavâ: anfractibus quinis, obtusé-ovalibus, sese partim involventibus; suturis profundis: aperturâ per-obliquâ, obcordatâ.*

This very pretty shell has a smooth, shining, nearly polished surface; it is depressed, nearly flat on the upper side, and moderately concave beneath. The volutions are five, separated by a deep suture, slightly convex on both faces, but rather more compressed on the under side than on the upper, obtusely rounded at the periphery, and each nearly half concealed by the succeeding volution. The aperture is very oblique and bluntly heart-shaped.

In the general form and rounded whorls, this species much resembles *P. sparnacensis* (Desh.), but the whorls are not so numerous, and the aperture is more oblique. The lenticular form and angulated margin of *P. lens,* will prevent its being confounded with that species.

*Size.*—Diameter, 7-10ths of an inch.

*Localities.*—Sconce; Headon Hill; Upper mar., Hordwell.

### No. 54. PLANORBIS DISCUS. *F. E. Edwards.* Tab. XV, fig. 7 *a—d.*

*P. testâ valde compressâ, quinquies circumvolutâ, supernè planâ, subtus profundè cavatâ: anfractibus sex, rapidè crescentibus, parum involventibus, subtus convexiusculis, ad marginem umbilicalem angulatis: aperturâ per-obliquâ, elongato-cordatâ.*

This well-marked species appears to be peculiar to the fresh-water formation at Sconce. It is a much compressed discoidal shell, nearly flat on the upper side and deeply hollowed out below. The five or six whorls of which it is formed enlarge rapidly, and each is slightly embraced by the succeeding one; they are much flattened above, slightly convex below, and obtusely rounded at the outer edge. In the young state, the inner margin is bent rather abruptly towards the preceding whorl, and presents an obtuse angle which defines the umbilicus, similar to that presented by *P. euomphalus* and *P. rotundatus.* As the shell approaches maturity, the under side assumes an almost regularly convex form, and the angle becomes obsolete. The aperture is very oblique, and of an elongated heart-shape.

The species which most resemble the present are *P. euomphalus* and *P. oligyratus.* From the first of these, it is distinguished by its more compressed discoidal form, and the rounded periphery. The whorls also enlarge more rapidly, and are consequently fewer and broader; and they embrace more of the preceding one than do those of *P. euomphalus.* The umbilical cavity also is not so wide. It is more difficult to separate the present species, in the young state, from *P. oligyratus;* but, in the latter, the axis is longer, the whorls are more convex on the upper side, and the obtuse angle which runs round the periphery, near the upper surface, gives a subtrigonal form to the whorls and the aperture, quite distinct from the transversely oval form in the present species.

Casts of this Planorbis occur in great abundance, but specimens with the shell preserved are extremely rare.

*Size.*—Diameter, 1 inch and 6-10ths.

*Locality.*—Sconce.

### No 55. PLANORBIS OLIGYRATUS. *F. E. Edwards.* Tab. XV, fig. 3 *a—e.*

*P. testá supernè sub-planá, subtus cavatá: anfractibus quaternis, rapidè crescentibus, parum involventibus, ad peripheriam obtusè angulatis: subtus ad marginem umbilicalem angulatis: aperturá sub-trigoná, parum obliquá.*

The present, like the preceding species, is apparently confined to the fresh-water formation at Sconce; but it is not so plentiful as *P. discus.* It is a moderately-sized shell, formed of four rapidly increasing whorls, somewhat convex above, and rather acutely angulated round the inner margins on the under side, just above the umbilicus. The periphery, near the upper surface, presents an obtuse angle, from which the whorls slope rather abruptly towards the umbilicus, assuming, in consequence, a subtrigonal form. The aperture is slightly oblique and bluntly obcordate, in consequence of its being impinged upon by the preceding whorl. The umbilical cavity is deep, but not very wide.

This species somewhat resembles the young shell of *P. discus;* but the greater convexity of the under side of the whorls, and the small degree of obliquity, and the shape of the aperture, will distinguish it. The adult shell of *P. discus* is easily separated by its greater size and compression.

The specimens ordinarily found are, like those of the preceding species, casts merely; with the shell preserved they are very rare.

*Size.*—Diameter, 7-10ths of an inch.

*Locality.*—Sconce.

### No. 56. PLANORBIS PLATYSTOMA. *S. Wood.* Tab. XV, fig. 2 *a—d.*

PLANORBIS PLATYSTOMA. *S. Wood.* Lond. Geol. Journ., vol. i, p. 118.

*P. testá parvá, utrinque fere equaliter cavatá; anfractibus trinis, rotundatis, tumidis, rapidè crescentibus, supra depressiusculis, subtus convexis, singulo fere dimidium antecedentis involventi: aperturá magná, per-obliquá, obtusè obcordatá, peristomate aliquando reflexo.*

A small smooth shell, formed of three tumid rapidly-enlarging whorls, each embracing about one half of the preceding one; the whorls are rounded, almost equally convex above and below, but a little compressed on the upper side. The apex is wholly concealed by the involution of the whorls. The aperture is wide, very oblique, and bluntly heart-shaped; sometimes, in the adult shell, the peristome is reflected. The upper side is slightly concave, and the under side presents a wide and moderately deep umbilicus.

This species, which appears to have been first noticed by Mr. Wood, is so well marked that it cannot be confounded with any other. It somewhat resembles the young shell of *P. oligyratus;* but, in the latter shell, the whorls are not so embracing, the upper side is more flattened, and the under side is not so regularly convex. The aperture, also, is narrower and much less oblique. The reflected lip, which frequently occurs in the present species, evidences the maturity of the shell; and the difference between the size of such specimens and that of the fully formed shell of *P. oligyratus* confirms the separation of the two species. In addition to these distinctions, it may be stated that the present species is found plentifully both in Headon Hill and at Hordwell; but that as yet no specimen of *P. oligyratus* has been found at either of those localities.

*Size.*—Diameter 3-10ths of an inch.

*Localities.*—Hordwell; Headon Hill; and Sconce.

### No. 57. Planorbis lens. *Brogniart.* Tab. XV, fig. 8 *a—d.*

Planorbis lens. *Brogn.* 1810. Ann. du Mus., vol. xv, p. 372, t. 22, fig. 9.
— — *Ib.* 1811. Journ. de Phys., &c. vol. lxxii, p. 421.
— — *Fér.* 1814. Mém. geol., p. 61, No. 10.
— — *Sow.* 1818. Min. Con., vol. ii, p. 91, t. 140, fig. 4.
— — *Desh.* 1824—37. Desc. des coq. foss., &c., vol. ii, p. 87, t. 9, figs. 11—13.
— — *Bouill.* 1836. Catal. des coq. foss. de l'Auvergne, p. 115.
— — *Desh.* Ency. Méth. Vers., &c., vol. iii, p. 783, No. 16.
— — *Ib.* 1838. Lam. Hist. Nat., 2d edit., vol. viii, p. 396, No. 7.
— *Morris.* 1843. Cat. Brit. Foss., p. 156.
*An.* planorbe anguleux? *Brard.* 1810. Ann. du Mus., vol. xiv, p. 435, t. 27, figs. 23-4.

*P. testâ parvâ, lenticulari, lævi, utrinque parum, sed plus superne quam subtus, cavatâ; anfractibus quaternis, singulo fere dimidium antecedentis involventi; supra convexiusculis, subtus plano-convexis, ad peripheriam acutè angulatis; aperturâ parum obliquâ, elongato-cordatâ.*

Mr. Sowerby, when he gave the name *P. lens* to a British fossil, appears not to have been aware that that name had previously been dedicated by Brogniart to a shell from the Paris basin; but, by a singular coincidence, the shells described by these authors appear to agree so closely that they must be referred to the same species. I have not, it is true, had an opportunity of comparing the English with the French shells; the identification, therefore, rests entirely on the figures and descriptions given by MM. Brogniart and Deshayes; but, forming my opinion from them, I cannot see any sufficient reason for considering the English shells as distinct. The present species is a small lenticular shell, slightly concave on each disc, but more so on the upper than on the under side: the whorls are four or five, each embracing nearly one half of the preceding whorl; they are slightly convex on both surfaces, but more so above than beneath, and acutely angulated round the periphery, a little below the middle of the whorl. The aperture is of an elongated heart-shape, and not very oblique.

Brogniart describes his shell as swelled out (bombé) and lenticular rather than umbilicated; and this, owing to the slight concavity of the discs, may be taken as the general character of the English shell. M. Deshayes, whose figures are drawn from the original specimen, states that in Brogniart's figure the shell is represented with the sides too much swelled out, and with the marginal angle too near the middle. Making due allowance for these errors, it will be seen that the contour of the shell and the form of the aperture represented by Brogniart's middle figure, agree very well with those of the English specimens.* In the figure given by Mr. Sowerby the aperture is represented as very obcordate, and it conveys the idea of the whorls and the shell being more convex than they really are. M. Bronn, in his 'Lethæa geognostica,' (p. 1011,) states that the shell described by Mr. Sowerby is more depressed than that of the typical *P. lens*, and he refers it to a distinct species, which he has named *P. Sowerbyi*. I fear that M. Bronn had not authentic specimens of our *P. lens* before him; for the figures he has given (Tab. XL, fig. 17 *a—c*,) do not correctly represent that shell; but they, as well as his description, agree closely with another of our Eocene *Planorbes*, which I have therefore referred to his species. The *P. lens* of 'Mineral Conchology' appears to me, as I have already stated, to correspond so closely with Brogniart's *P. lens*, that the two cannot be separated.

Férussac quotes Brard's *Planorbe anguleux* as a synonym; but whether the present species really is the same cannot well be determined without reference to the original specimen, as both the description and the figure given by Brard are too imperfect for the purpose of identification. I have, however, followed the example of MM. Brogniart and Deshayes, in quoting Brard with a query.

*Size.*—Diameter, 3-10ths of an inch nearly.

*Localities.*—Hordwell, and Headon Hill, where it is moderately plentiful. *French:* Saint-Chaumont, Pantin, Limagne, Cournon.

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* Judging from the aperture, Brogniart's figures are reversed, probably owing to an oversight of the artist.

No. 58. PLANORBIS TROPIS. *F. E. Edwards.* Tab. XV, fig. 10 *a—d.*

*P. testá minutá, depressá, lævi, superne parum concavá, subtus late umbilicatá: anfractibus quaternis vel quinis, lente crescentibus, supra convexiusculis, infra sub-planis, ad peripheriam carinatis, singulo dimidium antecedentis obtegenti: aperturá obliquá, angusticordatá.*

Mr. Wood ('London Geol. Journ.,' vol. i, p. 118,) has referred this species to *P. planulatus* (Desh.), observing, however, that "the figure by Deshayes is not so flat and carinated as the English specimens, which more resemble the *P. exacutus* (Gould)." I have not seen any French specimens of *P. planulatus;* but, on comparing the English shells with the description and figures given by M. Deshayes, I cannot concur in referring them to that species. *P. tropis* is a minute, compressed, polished shell, a little sunk round the apex, and widely but not deeply umbilicated; the four or five volutions, of which it is formed, are slightly convex above, nearly flat beneath, and compressed near the outer margin so as to present a prominent keel, which runs round the periphery a little below the middle of the whorl. The whorls are much concealed, each embracing about one half of the preceding one; the aperture is very oblique and of a longish heart shape.

Although the general resemblance between this species and *P. planulatus* must be admitted, yet there are, I think, sufficient grounds for specific distinction. In the present species, the whorls increase more slowly and are more concealed; they are not so convex above nor so flat beneath, and, consequently, the keel is near the middle of the shell, and the aperture assumes an elongated heart shape; whereas, in *P. planulatus,* owing to the greater flatness of the under surface of the whorls, the marginal angle (for, judging from the figure given by M. Deshayes, the term *keel* is not applicable,) runs round the base of the shell, and the aperture is sub-trigonal. The English shell also appears to be smaller than the French one. On these grounds, notwithstanding the distrust I feel at dissenting from Mr. Wood's opinion, I consider the present to be a distinct species. In the character and position of the keel, *P. tropis* corresponds with *P. exacutus;* but in the recent shell, the whorls enlarge more rapidly and are more convex, both above and below; the umbilicus is deeper, and the aperture wider, than in the present species.

*Size.*—Diameter, not quite 3-20ths of an inch.

*Locality.*—Hordwell.

No. 50. PLANORBIS HEMISTOMA. *Sowerby.* Tab. XV, fig. 11 *a—d.*

PLANORBIS HEMISTOMA. *Sowerby.* 1818. Min. Conch., vol. ii, p. 91; t. 140, fig. 6.

*P. testá minutá, depressá, lævi, superne profundé cavatá, subtus subplaná, ter quaterve circumvolutá; anfractibus vix involventibus, ad peripheriam sub-angulatis, supra convexi-*

*usculis, ad marginem sinistram acutè angulatis; infra subplanis; aperturá parum obliquá subtrigoná.*

A minute, smooth, much depressed shell, deeply concave on the upper side, almost flat on the under side: volutions three or four, very slightly convex above, nearly flat beneath, and compressed, almost angulated at the periphery above the middle of the shell. The whorls can scarcely be described as embracing, inasmuch as the under surface is wholly exposed, although the upper surface is partly concealed by the succeeding whorl; the inner margin is bent, rather abruptly, towards the apex, and presents a conspicuous angle, which runs round the cavity. The aperture is oblique, but not much so, and subtrigonal, having the lower margin rounded.

This species somewhat resembles *P. elegans;* but it is smaller and more compressed, and the subangulated periphery and flatness of the whorls impart a triangular form to the aperture very different from the roundish, heart-shaped aperture of that species. In *P. biangulatus,* the whorls are more convex, and the aperture is consequently almost obcordate.

*Size.*—Diameter, 1-10th of an inch nearly.

*Localities.*—Hordwell; Plumstead; Sundridge; Rotherhithe.

No. 60. PLANORBIS ELEGANS. *F. E. Edwards.* Tab. XV, fig. 12 *a—d.*

*P. testá minutá, politá, superne profundè cavatá, subtus parum cavatá; quater vel quinquies circumvolutá, anfractibus lineis incrementi notatis, ad peripheriam rotundatis; supra convexis, ad marginem sinistram angulatis; infra convexiusculis; singulo fere trientem antecedentis obtegenti: aperturá parum obliquá, obcordatá.*

This very elegant little Planorbis is found in great abundance on Headon Hill, in a deposit immediately above the upper fluvio-marine formation, associated with *Bulimus politus, Melanopsis carinatus, Melanopsis buccinoidea,* a species of *Neritina,* as yet undescribed, and *Melania muricata.* It is a small polished shell, deeply but not widely hollowed out on the upper disc, and slightly concave, almost flat, beneath: volutions four or five, rounded on the periphery, marked by conspicuous lines of growth nearly perpendicular to the axis, very convex, and presenting a sharpish angle running round the inner margin, on the upper surface, and but slightly convex beneath; each volution embraces nearly a third of the one preceding it. The aperture is of a roundish heart shape, and very slightly oblique.

*Size.*—Diameter, 3-20ths of an inch.

*Localities.*—The deposit in which this *Planorbis* principally occurs is a transition bed between the upper fluvio-marine and the pure fresh-water formations in Headon Hill. I have also found it, but very sparingly, in the upper fluvio-marine formation at Hordwell, and in the lower fluvio-marine or transition bed which intercalates the upper series of the true marine and the lower fresh-water formations at Mead End.

No. 61. **Planorbis biangulatus.** *F. E. Edwards.* Tab. XV, fig. 13 *a—d.*

*P. testâ parvâ, compressiusculâ, utrinque parum, sed fere equaliter cavatâ: anfractibus quinis, singulo antecedentem pauxillulo involventi; supra convexis, ad marginem sinistram angulatis; subtus convexiusculis, ad marginem externam obscurè crenulatis: aperturâ irregulariter obcordatâ, vix obliquâ.*

A small, somewhat depressed shell, slightly and nearly equally hollowed out on both sides, but rather more so above than beneath. It is formed of four or five volutions, convex on the upper side, and obtusely angulated round the cavity in consequence of the somewhat abrupt inflection of the inner margin toward the preceding volution; nearly flat on the under side, and obscurely crenulated near the outer margin. The periphery presents two angles; one, rather obscure, near the middle; the other, more prominent, runs round the margin of the lower disc. The aperture is slightly oblique, and of a short heart shape, but irregular in its form, owing to the greater convexity and the angulated inner margin of the upper surface of the whorl.

This appears to be a well-marked species; the double angle on the periphery and the crenulated under surface are characters which are not found in any other of the Eocene species.

*Size.*—Diameter, 2-10ths of an inch.

*Localities.*—Hordwell, as well in the pure fresh-water, as in the upper fluvio-marine formation; and at Mead End, in the lower fluvio-marine or transition bed before mentioned.

No. 62. **Planorbis Sowerbyi.** *Bronn.* Tab. XV, fig. 9 *a—d.*

Planorbis Sowerbyi. *Bronn.* 1838. Lethæa geognost., p. 1011, t. xl, fig. 17 *a—c.*

*P. testâ parvâ, depressâ, utrinque parum et fere equaliter cavatâ: anfractibus ternis vel quaternis, rapidè crescentibus; supra convexis, infra subplanis, ad peripheriam carinatis, singulo dimidium antecedentis obtegenti, carinâ inferiori; aperturâ elongato-cordatâ, per-obliquâ.*

The present species appears to be rare. It is a small depressed shell, slightly and nearly equally hollowed out on both surfaces; but the umbilical cavity is the wider and deeper of the two. The volutions are three or four, enlarging rapidly, convex above, nearly flat beneath, and bearing a sharpish keel on the periphery, formed by the compression of the outer margins, a little below the middle of the shell. The whorls are much concealed, each embracing nearly half of the preceding one, and the aperture is very oblique, and of an elongated heart shape.

This shell appears to me, as I have already stated, to have been mistaken by M. Bronn for that described by Mr. Sowerby as *P. lens*, and to have been correctly referred to a distinct species. It certainly presents a general resemblance to *P. lens;* but the upper side is more arched, the under side flatter, the whorls enlarge more rapidly, and the margins are more compressed and more acutely carinated than in that species; the umbilical cavity, also, is not so deep, and the aperture is of a more oblique and of a more elongated heart shape.

In the rapidly increasing size of the whorls and the condition of the marginal keel, the present species presents an analogy with the recent *P. exacutus* (Gould); but in the latter shell, the upper sides of the whorls are not concealed, the under sides are more convex, the umbilical cavity is deeper, and the aperture is almost obcordate. In *P. tropis* the shell is more compressed, the whorls enlarge more slowly, and the umbilical cavity is wider.

*Size.*—Diameter, 2-10ths of an inch.

*Locality.*—Sconce.

PLANORBIS CYLINDRICUS.—Mr. Sowerby has described a shell under this specific name, (Min. Conch., vol. ii, p. 90, t. 140, fig. 2,) the distinguishing characters of which are the vertically flattened, adpressed volutions, concentrically striated on the under surfaces, and the oblong quadrangular aperture. I have not met with any specimen which presents these characters; and as the original specimen, unfortunately, has been broken, I cannot give any description or figure of the species. It is not improbable that the shell described by Mr. Sowerby was a fragment, consisting of the early volutions of one of the larger species I have described, possibly of *P. rotundatus,* in which the whorls, in the young state, are somewhat adpressed and the aperture is subquadrate.

### Genus 14th. ANCYLUS.* *Geoffroy.*

ANCYLUS, *Geoffroy,* 1767; *Müller,* 1774; *Draparnaud,* 1805; *De Roissy,* 1805; *Férussac,* 1819; *Lamarck,* 1820; *Blainville,* 1825; *Guilding,* 1821.
PATELLA (spec.), *Linnæus, Bruguière, Montagu.*
HELCION (spec.), *Montfort,* 1810.
ANSULUS vel ANSYLUS, *Gray,* 1840.

*Gen. Char.*—Patelliform, thin, obliquely conical, sinistral; apex rather pointed, compressed, not lengthened nor spiral, turned sidewise towards the right margin and backwards, not marginal: aperture oval or oblong, margins simple.

This genus, first withdrawn by Geoffroy from the *Patellæ,* was rejected both by Linnæus and Bruguière, but was revived by Draparnaud, and placed near the *Limnæidæ,* on account of the similarity between the animal and those of *Limnæa* and *Planorbis.* Férussac, who had noticed the occasional ascent of the animal to the surface of the

* Etym. Ἀγκύλος, crooked, twisted.

water, and assumed that this was for respiration, also placed the genus among the aquatic Pulmonata. On the other hand, Lamarck and Blainville, although they adopted the genus, retained it, provisionally, the former among the *Calyptracea*, the latter among the *Scutibranchia*. Subsequently, the Rev. Mr. Guilding, in his 'Zoology of the Caribean Islands,'* gave the generic characters of the animal, and described the respiratory apparatus as consisting of a small branchial plume placed on the left side, near the excretory orifice; and M. Deshayes, misled by this description, has, in the 2d edition of Lamarck's 'Histoire Naturelle,' rejected the supposition of the animal being a pulmonated mollusc. The more recent observations of the Rev. G. M. Berkeley† have shown, however, that the animal, in its organs of respiration, resembles those forming the present order, and that it is, in fact, a true pulmonated mollusc. The respiratory orifice is protected by a valvular enlargement of the margin of the mantle, which, it is conjectured, was mistaken by Mr. Guilding for a branchial plume. The genus, as originally proposed, embraced as well dextral as sinistral species. The dextral species have been withdrawn by Mr. Gray, under the generic name *Velletia*, (*Acroloxus*, Beck;) a division the necessity for which has been questioned, but which, for the reasons stated under the genus *Velletia*, I have adopted, and the present genus is therefore confined to the sinistral species.

The animal is hermaphrodite, but the union of two individuals is necessary for fecundation: the head is furnished with two cylindrical or triangular retractile tentacles, oculated at their bases; the foot is short, and attached to the abdominal mass, and the mantle is large and free, with a simple continuous margin. The living species are not numerous; one only, *A. fluviatilis*, is found in this country and in central and southern Europe; the rest occur principally in central America. They live in fresh-water, preferring gentle streams.

Four fossil species have been described and referred to this genus, all from the Eocene formations, viz. *A. elegans* (Sow.), from Hordwell; *A. depressus* (Desh.), from the neighbourhood of Versailles; *A. deperditus* (Desmar.), from the fresh-water limestone of Ulm; and *A. compressus* (Nyst.), from the neighbourhood of Antwerp. The first two are *Velletiæ;* the descriptions and figures of the last two are insufficient for determining to which genus they belong.

### No. 63. ANCYLUS? LATUS. *F. E. Edwards.* Tab. XIV, fig. 15 *a-b.*

*A. testá conoideá, depressá, latá; vertice submediano: aperturá oblongá, obovatá.*

The imperfect state of the only specimen I possess, prevents my doing much more than to record the occurrence of this shell, which I refer to the present genus with hesitation. It is distorted at the posterior extremity, and presents the appearance of a sinus somewhat resembling that in the shells of the Limacina, but greatly exaggerated; this, most probably, is due to the accident which produced the distortion, or to some cause similar to that to which Mr. Gray attributes the sinus in Michaud's *A. sinuosus.* The shell also is thicker than is usual in this genus; but the shelly matter has been absorbed and replaced by carbonate of lime, and a slight thickening may have taken place in that process. It may be described as sub-conical, and much depressed, with the vertex about half way between the margin and the middle; the aperture is oblong and widely obovate. In the great depression of the shell this species resembles *A.* (Velletia) *depressus,* Desh.; but the aperture is more equally rounded at the extremities.

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* 'Zoological Journal,' vol. iii, p. 535.

† Ibid., vol. v.

*Size.*—Length about ¼ of an inch; width, about 2-10ths.

*Locality.*—Sconce.

## Genus 15th. VELLETIA.* *Gray.*

ACROLOXUS, *Beck,* 1837.
VELLETIA, *Gray,* 1840.

*Gen. Char.*—Dextral, with the apex turned sidewise towards the left margin; in all other respects resembling Ancylus.

The dextral forms referred to *Ancylus* were first withdrawn by Beck, under the generic name *Acroloxus,* but without any description; the genus was afterwards defined by Mr. Gray under that of Velletia. The animal, so far as its organisation is known, as well as the shell, resembles *Ancylus,* except that it is dextral and not sinistral; and the genus has not been received without question, inasmuch as, apparently, it depended on a character insufficient in itself for generic distinction. Mr. W. Thompson, however, in his 'Remarks on the dentition of British Pulmonifera,' to which I have before referred, states that, in their dentition, "*Ancylus* and *Velletia* present widely distinct characters, clearly showing that they do not belong to one genus. In *Ancylus* there are thirty similar lateral teeth in a straight line on each side of the central tooth, and then there is a slight curve through a series of six more teeth, where a trifling change in their form occurs. In *Velletia,* on the contrary, no part of the horizontal row is straight; its central part is much arched, and is composed of the central tooth and twelve lateral teeth on each side, which do not alter much in form. Then comes one tooth of a different form, and lastly, six more on each side, which latter are in a slight curve." A closer examination of the comparative anatomy of the two animals will probably afford additional reasons for the separation of the present genus; in the meantime, I have retained it on the ground of the different characters of the dental apparatus recorded by Mr. Thompson.

The living species are very few: one, *V. lacustris,* is found in this country; the others occur principally in the West Indies and South America. The two species before mentioned, *V. elegans* (Sow.), and *V. depressa* (Desh.), are, I believe, the only fossil species hitherto described.

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* A name without signification, used by Mr. Gray on the principle advocated by Fabricius.

### No. 64. VELLETIA ELEGANS. *Sowerby*. Tab. XIV, fig. 2 *a—d*.

ANCYLUS ELEGANS. *Sow.* 1826. Min. Con., vol. vi, p. 64, t. 533.
— — *Lyell and Murch.* 1829. Sur les depôts, &c. du Cantal.
— — *Bouillet.* 1836. Cat. des coq. foss. de l'Auvergne.

*A. testâ convexâ, subconicâ, radiatim subtilissime striatâ; vertice obliquo, excentrico, sub-marginali: aperturâ longitudinali, ob-ovali.*

This elegant shell, for the discovery of which we are indebted to Sir Charles Lyell, is convex and subconical, with an oblique excentric vertex, placed near the posterior extremity. The surface, under a high magnifying power, presents exceedingly fine striæ, radiating from the vertex towards the margin; the mucro is frequently eroded. The aperture is longitudinal and obovate, the wider part being the anterior extremity.

The shell, in this species, is not so oblong and compressed as in the recent *V. lacustris*, and the vertex is nearer the margin. In the French species, *V. depressa*, (Desh.) the shell is more depressed, the anterior extremity is wider, the posterior extremity is narrower, and the vertex is more nearly central.

*Size.*—Elevation rather more than 1-20th of an inch; length rather more than 3-20ths; greatest width 2-20ths.

*Localities.*—Hordwell. *French:* Veaurs in the Cantal.

## *Family*—AURICULIDÆ.

### Genus 16th. MELAMPUS. *Montfort.*

VOLUTA, (sp.,) *Linn.*
MELAMPUS, *Montf.*, 1810; *Beck*, 1837; *Gray*, 1840.
CONOVULUS, *Lam.*, 1812; *Cuvier*, 1817; *Beck*, 1837.
AURICULA, (sp.,) *Lam.*
ALEXIA, *Leach*, 1819
CONOVULA, *Féruss.*, 1819.
PEDIPES, (sec. C.,) *Blainville*, 1825.
MELAMPUS, *Lowe*, 1832.
CONOVULUM, *G. Sowerby, jun.*, 1841.
RHODOSTOMA and MELAMPUS, *Swain*, 1840.

*Gen. Char.*—Shell oval or elongate, sub-cylindrical; generally smooth, and with a short conoidal spire: aperture rather long and narrow; peritreme continuous, with two or three folds upon the columella; outer lip sometimes simple and sharp, sometimes thickened, and occasionally denticulated within.

The genus *Auricula,* as described by Lamarck, was confined to land shells; and that of *Conovulus,* proposed by him for certain shells which he considered to be fluviatile, he afterwards suppressed under the impression that they also were land shells. The animals which have been referred to the genus *Auricula* have, however, various habitats: some are terrestrial; others live in ponds or fresh-water marshes; and others, again, are inhabitants of the sea, or are found in brackish water near the mouths of rivers, or in salt-water marshes. Some of these groups are distinguished by peculiarities in the animals or their shells; and they, accordingly have been withdrawn from *Auricula* as distinct genera. The present genus, which corresponds with Lamarck's *Conovulus,* was first separated by Montfort for a shell from the shores of Cayenne. The animal resembles that of *Limnæa;* the head is proboscidiform, notched in front, and furnished with two filiform contractile tentacles, slightly annulated, and oculated at their inner bases; the foot is obovate and obtuse before and behind; the mantle united to the neck, with the exception of a perforation at the junction of the outer and inner lips. The *Melampodes* are strictly marine animals, although they are frequently found in brackish waters near the mouths of rivers or salt-water marshes; they are capable of living out of water for a long period, and Mr. Lowe, in fact, characterises them as amphibious.

The living species are not numerous; three are inhabitants of our own shores; the others are found principally in warm climates. The fossil species hitherto described are from the Eocene and later formations, and have for the most part been referred to *Auricula.*

The peculiarity, observed by Montagu in *Auricula denticulata,* of the columella not extending further than the upper part of the body whorl, is stated by Mr. Gray to be common to most species in the family; and to be caused generally by the animal absorbing the septa which separate the upper whorls, and thus converting the spire into a single cavity, as it enlarges the shell at the edges of the aperture.

### No. 65. MELAMPUS TRIDENTATUS. *F. E. Edwards.* Tab. X, fig. 4 *a—b.*

*M. testâ ovato-ventricosâ, crassâ, lævi; spirâ conico-depressâ, apice obtusiusculo; anfractibus sex vel septem, sub-cylindraceis, superne depressiusculis: aperturâ auriformi, angustâ, labro interne incrassato, antice reflexo: columellâ marginatâ, tridentatâ.*

A thick, smooth, ovate, ventricose shell, with a short conical spire and a bluntish apex; volutions six or seven, sub-cylindrical, and somewhat depressed round the suture; the aperture long, narrow, and ear-shaped; the outer lip rather enlarged and inflected in front, and thickened internally, presenting an elevated sharpish ridge, which extends from a little above the middle of the whorl to the columellar lip. The columella is furnished with three distinct folds, of which the middle one is the largest and the posterior one the smallest; the outer lip is slightly reflected, but not so as to cover the umbilicus.

This species, in its general form, much resembles *C. pyramidalis* (Sow.), but the whorls are not so convex, and the sutures are nearer to each other, so that the spire is shorter and the aperture longer and narrower. The columella also presents three folds, instead of the two which distinguish the crag species.

The shell figured is, I believe, unique; it is one of the many valuable additions made to our Eocene fauna by the "English Natural History Society," under the able direction of Mr. Charlesworth. It forms part of the collection in the Museum of the Philosophical Society of York, who have kindly allowed me the use of it for description.

*Size.*—Axis, 7-10ths of an inch nearly.

*Locality.*—High Cliff, Hampshire.

### Genus 17th. PEDIPES.* *Adanson.*

PEDIPES, ***Adanson,*** 1757.
— ***Féruss.***, 1819; ***Menke,*** 1828; ***Desh.***, 1832; ***Beck,*** 1837; ***Bronn,*** 1838; ***Gray,*** 1839; ***Swain.***, 1840; ***G. Sow., jun.***, 1842; ***Desh.***, 1843.
— (sec. B), ***Blainville,*** 1825.
POLYDONTA (sp.), ***Fischer.***
BULIMUS (sp.), ***Bruguière.***
TORNATELLA (sp.), ***Lamarck.***
AURICULA (sp.), ***Reeve.***

*Gen. Char.*—Shell small, thick, sub-globose or oval; spire pointed, not much elevated: aperture sub-ovate or linear; outer lip thin, sharp, with one or two folds within; columella with two folds; one large fold on the penultimate whorl.

This genus was proposed by Adanson on a small marine shell from the coast of Senegal; and, although it was confounded by Bruguière with *Bulimus,* and by Lamarck with *Tornatella,* it appears to have been generally adopted. The animal, which Adanson describes as very small in comparison with the shell, is furnished with two filiform tentacles, oculated at their inner bases; the muzzle is rounded and notched in front, as in *Melampus* and *Limnæa;* the foot is elliptical and divided into lobes separated by a deep transverse furrow; the anterior lobe is transverse, wider than long, and rounded in front; the posterior one longer than wide, and somewhat narrowed behind. The mode of progression, as described by Adanson, is as follows: the animal, having attached itself by the posterior lobe, protrudes the anterior lobe as far as the hollow part of the foot, which is capable of considerable extension, will permit; and the posterior lobe is then advanced until it touches the anterior one. This movement, quickly repeated, enables the animal to advance with a rapidity apparently disproportioned to its size. Adanson states that, on the animal emerging from or withdrawing into the shell, the lobes pass one on each side of the large posterior fold, which, being continued into the interior of the shell, keeps them constantly separated.

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* Etym. Adanson gave the name *Pietin* (quasi *pieton,* a walker,) to this genus on account of the singular way in which the animal walks, and the Latin name, *Pedipes,* imposed by him, has probably reference to this peculiarity.

Only three or four living species are known, all from tropical regions. Of fossil species, M. D'Orbigny, in his 'Prodrome de Paléontologie,' cites five, which he refers to this genus, from the Eocene formations in France.

No. 66. **PEDIPES GLABER.** *F. E. Edwards.* Tab. X, fig. 9 *a—c.*

*P. testâ minutâ, ovali, ventricosâ, glabrâ; anfractibus quaternis vel quinis, ad suturam adpressis; spirâ mediocri: aperturâ semiovali; labro uniplicato, antice intus incrassato; plicâ columellari posteriori, angulatâ, flexâ.*

A minute, oval, ventricose and smooth shell; volutions four or five, adpressed at the posterior margins so as to form a narrow band round the suture; the spire moderately elevated: the aperture semioval; the outer lip with a sharp edge, and furnished with a fold placed about the middle, and in front of which the lip is thickened internally; the large columellar fold on the penultimate whorl is angulated and bent so as to present a slight concavity on the anterior surface, and a corresponding convexity on the posterior one.

This exceedingly rare and interesting shell forms part of Mr. D'Urban's valuable collection.

*Size.*—Axis, 2-20ths of an inch nearly; diameter, rather more than 1-20th.

*Locality.*—High Cliff.

## SUB-ORDER—*PHANEROPNEUMONA* (Gray), *OPERCULATA*, (Férussac.)

### *Family*—CYCLOSTOMIDÆ.

### Genus 18th. CYCLOTUS.* *Guilding.*

CYCLOTUS, *Guild.*, 1840, (fide *Swainson.*)
POTERIA, *Gray*, 1840.
APEROSTOMA, *Troschel*, *Pfeiffer*, 1847.
CYCLOTUS, *Gray*, 1850.

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* Etym., *κυκλωτος*, rounded.

*Gen. Char.*—Spire sub-turbinate, depressed, or discoidal; apex obtuse; whorls rounded: aperture nearly circular, with a small siphon at the posterior extremity; peristome simple, sometimes reflected; widely umbilicate: operculum thick, calcareous, formed of two laminæ with a groove on the edge between them; outer surface rather concave; whorls numerous, enlarging gradually, with the outer edge reflected, forming a spiral fringe.

The genus *Cyclostoma*, as originally proposed by Lamarck, rested entirely on the circular form of the aperture, a character which applied as well to land as to marine and fresh-water species, and brought together animals essentially different, not only in their organisation, but in the structure of their shells. From this heterogeneous group, Draparnaud withdrew the marine species, and restricted the genus to the land and fresh-water species; and Lamarck afterwards formed for the marine and fresh-water species the genera *Scalaria, Delphinula, Paludina* and *Valvata*, and confined the genus to the free-air breathing land species. The animal is unisexual and operculated, with a proboscidiform head, furnished with two subulate annulated tentacles, oculated at their external bases; the respiratory opening, unlike that of the preceding sub-order, is largely open in front, resembling that of many of the branchiated molluscs. These characters separate the genus and its sub-genera as a distinct group among the pulmonated molluscs. The modification of the organs of respiration, to which many zoologists have attached great importance, has been considered by others as a character of comparatively small value; and the resemblance which the animal of *Cyclostoma* presents to that of *Turbo*, in many important particulars, induced Cuvier to disregard the peculiarity of the respiratory apparatus, and to place the genus in the same family as *Turbo;* and M. Deshayes* has suggested that the *Cyclostomidæ* should form a distinct group near to or among the *Turbinacea.* Such an arrangement, however, cannot consistently be adopted in any system in which the mode of respiration is admitted as an ordinal character; and consequently the *Cyclostomidæ* are retained, almost universally, among the pulmonated molluscs.

As ultimately restricted by Lamarck, the genus *Cyclostoma* comprised two groups, which presented distinct forms of the operculum; that appendage being formed, in one group, of a few rapidly enlarging whorls, and, in the other, of numerous slowly increasing whorls. Each of these groups comprised species in some of which the shells were more or less widely umbilicated, and in others imperforate, or nearly so. Montfort availed himself of the condition of the umbilicus, a character in itself of little generic value, and separated the widely umbilicated species under the generic name *Cyclophorus*, retaining the imperforate species for his genus *Cyclostomus;* but the characters presented by the opercula were altogether overlooked or disregarded. Each genus, therefore, comprised species presenting different forms of operculum;

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* Lam. Hist. naturelle, 2d edit., vol. viii, p. 351.

and numerous genera and sub-genera have, in consequence, been withdrawn by Gray, Guilding, Troschel, Pfeiffer, and others, on characters taken principally from modifications of the operculum. The present genus was separated by Mr. Guilding, from *Cyclophorus*, for some shells from the West Indies; it is distinguished by the thick calcareous operculum, formed of two distinct layers. The animal, so far as it is known, resembles that of *Cyclostoma.*

The recent species are not very numerous. Mr. Gray, in his Nomenclature of Molluscous Animals, &c., in the British Museum, part "Cyclophoridæ," gives a list of twenty-eight species, all of which are from the West Indian Islands, or from Central or South America.

### No. 67. CYCLOTUS CINCTUS. *F. E. Edwards.* Tab. X, fig. 1 *a—c.*

*C. testá conico-depressá, lineis tenuibus spiraliter cinctá; anfractibus quinque vel sex, rotundatis, ultimo paullo decurrenti: umbilico magno; aperturá sub-circulari.*

This remarkably elegant shell is conical and somewhat depressed, formed of five or six rounded whorls, and ornamented with numerous, irregular, rather sharp, spiral, raised lines, some of which are more elevated than the rest; these lines are spread over the whole surface of the shell; but they are more crowded on the upper than on the under surface, and are very prominent in the umbilicus, where they are sometimes strongly decussated by the lines of growth. The last whorl is slightly decurrent; the aperture is nearly round, with the peristome a little reflected, but not much so; and the umbilicus is very wide, being nearly one third of the diameter of the shell.

Two or three detached opercula have been obtained by Mr. D'Urban, which present all the leading characters of the opercula of the living species; but, as yet, it cannot be determined to which of the two fossil species they belong. They are thick, testaceous, slightly concave externally, formed of five or six slowly enlarging whorls with the external fringe deeply grooved. One of them is represented by fig. 12 *a—b,* Tab. X.

This species has hitherto been found only at Sconce, where it occurs rather plentifully; but specimens with the shell preserved are rare.

*Size.*—Axis, 5-10ths of an inch; diameter, rather more than 6-10ths of an inch.

### No. 68. CYCLOTUS NUDUS. *F. E. Edwards.* Tab. X, fig. 11 *a—b.*

*C. testá ovato-conicá, lævi; spirá mediocri; anfractibus quinis convexis: aperturá rotundatá, umbilico parvo.*

A smooth ovately-conical shell, with a moderately elevated spire, formed of five convex volutions: aperture nearly circular; umbilicus narrow but deep.

The surface of the shell in this species is perfectly devoid of ornament, a character which at once separates it from the preceding species; the casts, in which state specimens are most commonly found, may be distinguished by the more elevated spire, the less effuse base, and the narrower umbilicus.

*Size.*—Axis, half an inch; diameter, nearly the same.

*Locality.*—Sconce, where, although it is not by any means rare, it is not so common as *C. cinctus.*

### Genus 19th. CRASPEDOPOMA.* *Pfeiffer.*

CRASPEDOPOMA, *Pfeiff.*, 1847.
VALVATA (sp.), *Menke.*
BOLANIA, *Gray*, 1842.

*Gen. Char.*—Shell sub-turbinate; last whorl slightly produced, straight, attenuated towards the aperture, which is circular; peristome continuous, simple, slightly thickened; axis imperforate or narrowly umbilicate.

This is one of the genera, separated by Pfeiffer, (Zeitsch. für Malak.,) depending principally on the characters presented by the operculum. That appendage in the present genus differs from the operculum of *Cyclotus*, in being horny instead of calcareous; and in having, on the outer edge of the internal disc, a circular prominence which overlaps the margin of the aperture; the external disc is also flat, and not concave, as in *Cyclotus*. The shell is distinguished by the attenuation of the last whorl, which gives a contracted appearance to the aperture, a character not found in any other group of the *Cyclostomidæ*. Only two living species are known; both are from Madeira.

### No. 69. CRASPEDOPOMA ELIZABETHÆ. *F. E. Edwards.* Tab. XIV, fig. 14 *a—c.*

*C. testâ parvâ, conicâ, perforatâ; lineis spiralibus, numerosis, tenuissimis, ornatâ; apice obtusiusculo: anfractibus quinis, rotundatis, ultimo decurrenti: aperturâ circulari, intus incrassatâ; umbilico angusto.*

A small trochiform shell, ornamented with numerous fine, spiral, raised lines, and formed of four or five rounded volutions, the last of which is attenuated towards the aperture and slightly decurrent; the spire is moderately elevated, with a somewhat blunt apex: the aperture is nearly circular, and slightly thickened internally; the umbilicus is narrow.

Without the assistance to be derived from the operculum, it is scarcely possible to determine correctly to what genus the present shell should be referred. It has much the appearance of a *Valvata;* but the thickened peristome indicates its affinity to the

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* Etym., κράσπεδον, a rim or border; πωμα, a lid, (the operculum.)

*Cyclostomidæ*, and the attenuation of the last whorl induces me to place it in the present genus, apparently the only one in the family to which that character belongs. I refer it, however, to *Craspedopoma* provisionally only, until, by the acquisition of more perfect specimens, its true position may be ascertained.

This elegant shell was discovered by Mr. D'Urban and myself, on a recent visit to the Isle of Wight, accompanied by Miss D'Urban, to whom, in commemoration, I have ventured to dedicate it. It is apparently very rare, and although we procured several specimens, not one had the shell preserved.

*Size.*—Axis, 4-20ths of an inch; diameter, 3-20ths nearly.

*Locality.*—Sconce.

HELICINA.—The shell described by Lamarck as *Helicina dubia* is found in the High Cliff sands, and at Barton; it is, however, a *Rotella*, and will be described in its proper place.

In order that this account of our Eocene pulmonated molluscs may contain all the species at present known, I subjoin the description of a shell acquired by me since the early part of this monograph was printed, and which I have referred to *Bulimus*, although the aperture is of a form unusual in that genus.

### No. 70. BULIMUS HETEROSTOMUS. *F. E. Edwards.* Tab. XIV, fig. 1 *a—d.*

*B. testâ parvâ, conicâ; spirâ elevatâ, acutiusculâ, apice deciduo; anfractibus septenis vel octonis, rotundatis, transversim regulariter lineatis; lineis tenuissimis, numerosis, perobliquis: aperturâ rotundo-ovatâ, peristomate reflexo.*

This shell has so much of the character and appearance of *Truncatella*, that I should be inclined to refer it to that genus; but it is found associated with land and true fresh-water shells only, in a formation which does not present any trace of marine origin. The nearly circular aperture resembles that of *Cyclostoma;* the transverse lineation, however, is a character which, I believe, is not ever found in that genus. I have referred it to *Bulimus*, but with some hesitation. It is a small conical shell, with an elevated, tapering, pointed, spire, the apex of which is subject to decollation; the seven or eight whorls of which it is formed, are rounded, separated by a deep suture, and ornamented with fine transverse raised lines, which are numerous, regular, and very oblique; the aperture is roundedly ovate, apparently thickened within, and with the margin slightly reflected. In specimens which have not attained the full size, the bases of the whorls are flattened and sharply angulated at the outer margins.

This species appears to be well characterised; it is separated by the striation and the form of the aperture, from the several small fossil species described by Lamarck and by Deshayes.

*Size.*—Axis 3-10ths of an inch; diameter not quite 3-20ths.

*Localities.*—Sconce and Headon Hill; apparently, it is very rare.

I cannot close the present Monograph without noticing certain oviform substances which occur, rather plentifully, in the fresh-water formation at Sconce, as to the nature and origin of which various opinions have been entertained. I have been fortunate enough, however, to obtain lately, specimens which appear to me to remove all doubt on the subject, and to show conclusively that these substances are, in fact, the remains of the eggs of some animal. The condition in which they most usually occur, is that of casts formed of the same material as the rock in which they are imbedded; they present great regularity of form, and resemble, in every respect, the internal cast of an egg. Occasionally only a hollow space, the impression of the egg, is found without the internal cast, and without the calcareous covering, which has been wholly absorbed; and sometimes, though more rarely, the covering of the egg itself occurs; but in that case the calcareous matter has always been replaced by carbonate of lime, and in this state the inside is sometimes empty—sometimes it is filled with the matrix. The absorption of the calcareous matter, and its occasional replacement by carbonate of lime, are the conditions in which, as we have already seen, the testaceous remains of Mollusca imbedded in the same formation are frequently found. The hypothesis that these substances are the casts or remains of eggs, appears to me to be the only one by which the different states in which they are found can be satisfactorily explained. Where the egg has been broken, the cavity of the shell has been filled by the fluid matrix, and the internal cast is formed. The eggs may, in some instances, have been broken accidentally; but they appear almost universally to have been broken by the young animal on effecting its escape; for one end of the casts is free, smooth, and regular in form; while the other end, apparently broken by the animal, is irregular and connected with the external matrix. If, on the other hand, the egg has been imbedded unbroken, only the cavity formed by it in the matrix remains; or if the covering of the egg is found, it is either quite empty, or small globules of the carbonate of lime, by which the shell has been replaced, are found attached to the sides. I assume therefore that the substances in question are the remains of eggs, but of what animals it is more difficult to determine. They are of different sizes, varying in length from 2-10ths of an inch to nearly two inches; in shape they are oval, rounded equally at both

## TAB X.

Fig.

1. Cyclotus cinctus. No. 67, *p.* 117.
   - *a.* Back view of specimen with the shell preserved.
   - *b.* Front view of a cast.
   - *c.* Back view of ditto.

2. Helix globosa. No. 16, *p.* 63.
   - *a.* Front view of a cast of a shell in an intermediate stage of growth.
   - *b.* Front view of a cast of a young shell.
   - *c.* Back view of an adult specimen with the shell partly preserved.
   - *d.* Front view of ditto.

3. Helix tropifera. No. 18, *p.* 64.
   - *a.* Front view of a cast.
   - *b.* Upper surface of ditto.
   - *c.* Under surface of ditto.

4. Melampus tridentatus. No. 65, *p.* 113.
   - *a.* Front view.
   - *b.* Back view

5. Helix D'Urbani. No. 15, *p.* 62.
   - *a.* Front view, nat. size.
   - *b.* Ditto, magnified.
   - *c.* Under surface, magnified.
   - *d.* Upper surface ,,

6. Helix omphalus. No. 19, *p.* 65.
   - *a.* Front view, natural size.
   - *b.* Ditto, magnified.
   - *c.* Upper surface, ditto.
   - *d.* Under surface, ditto.
   - *e.* Portion of a whorl, magnified.

Fig.

7. Helix labyrinthica. No. 20, *p*. 67.
    - *a*. Back view, natural size.
    - *b*. Under surface, magnified.
    - *c*. Back view, ditto.
    - *d*. Front view, ditto.
    - *e*. Portion of the whorl magnified.

8. Helix Vectiensis. No. 14, *p*. 62.
    - *a*. Back view, natural size.
    - *b*. Under surface of a cast, magnified.
    - *c*. Front view, magnified.
    - *d*. Back view of a cast, ditto.
    - *e*. Portion of the whorl, magnified.

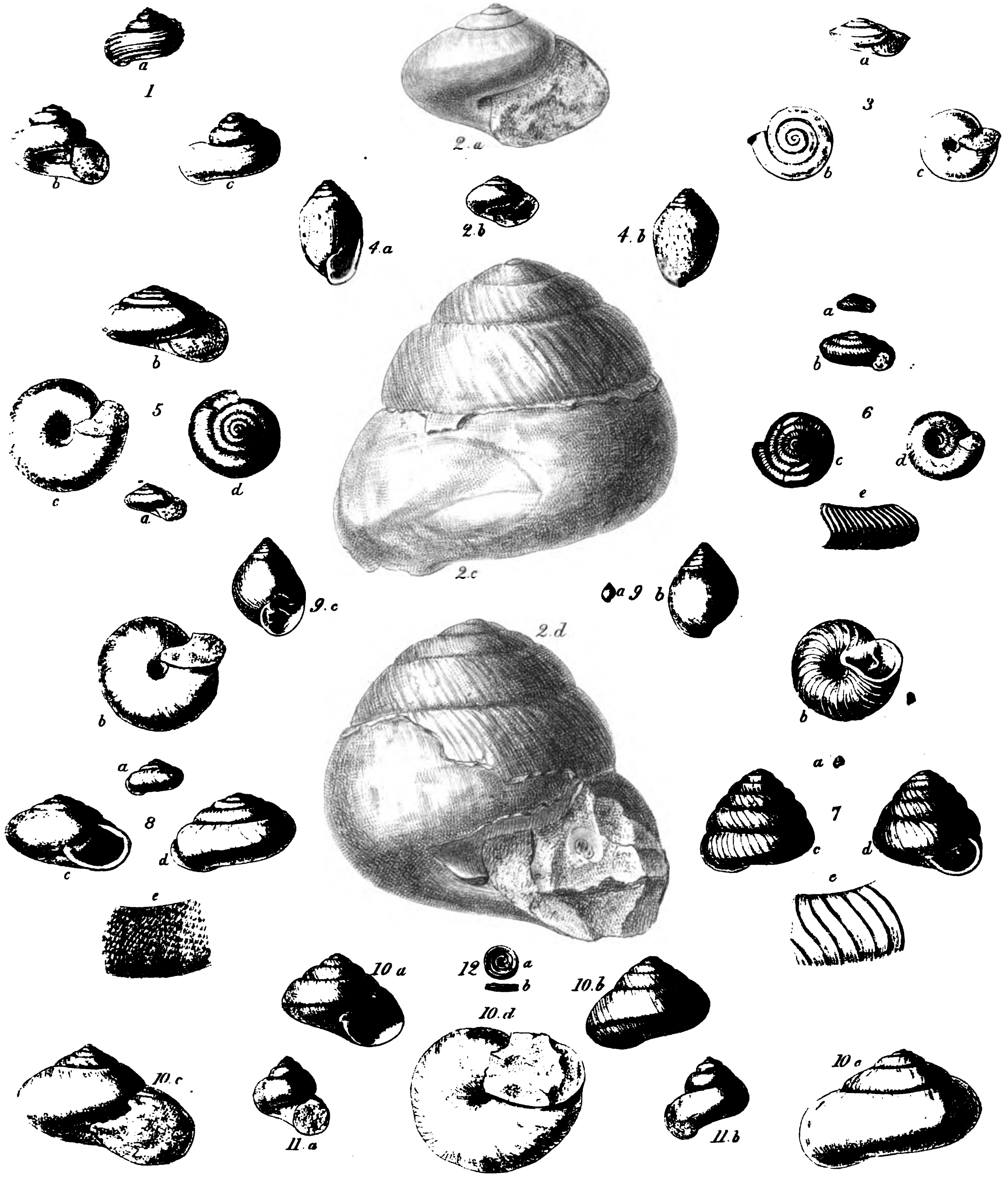
9. Pedipes glaber. No. 66, *p*. 115.
    - *a*. Back view, nat. size.
    - *b*. Ditto, magnified
    - *c*. Front view, ditto.

10. Helix occlusa. No. 17, *p*. 64.
    - *a*. Front view of a specimen with the shell preserved.
    - *b*. Back view of ditto.
    - *c*. Front view of a cast.
    - *d*. Under surface of ditto.
    - *e*. Back view of ditto.

11. Cyclotus nudus. No. 68, *p*. 117.
    - *a*. Front view.
    - *b*. Back view.

12. Operculum of *Cyclotus*.
    - *a*. View of the outer disc.
    - *b*. Side view.

Tab. X.



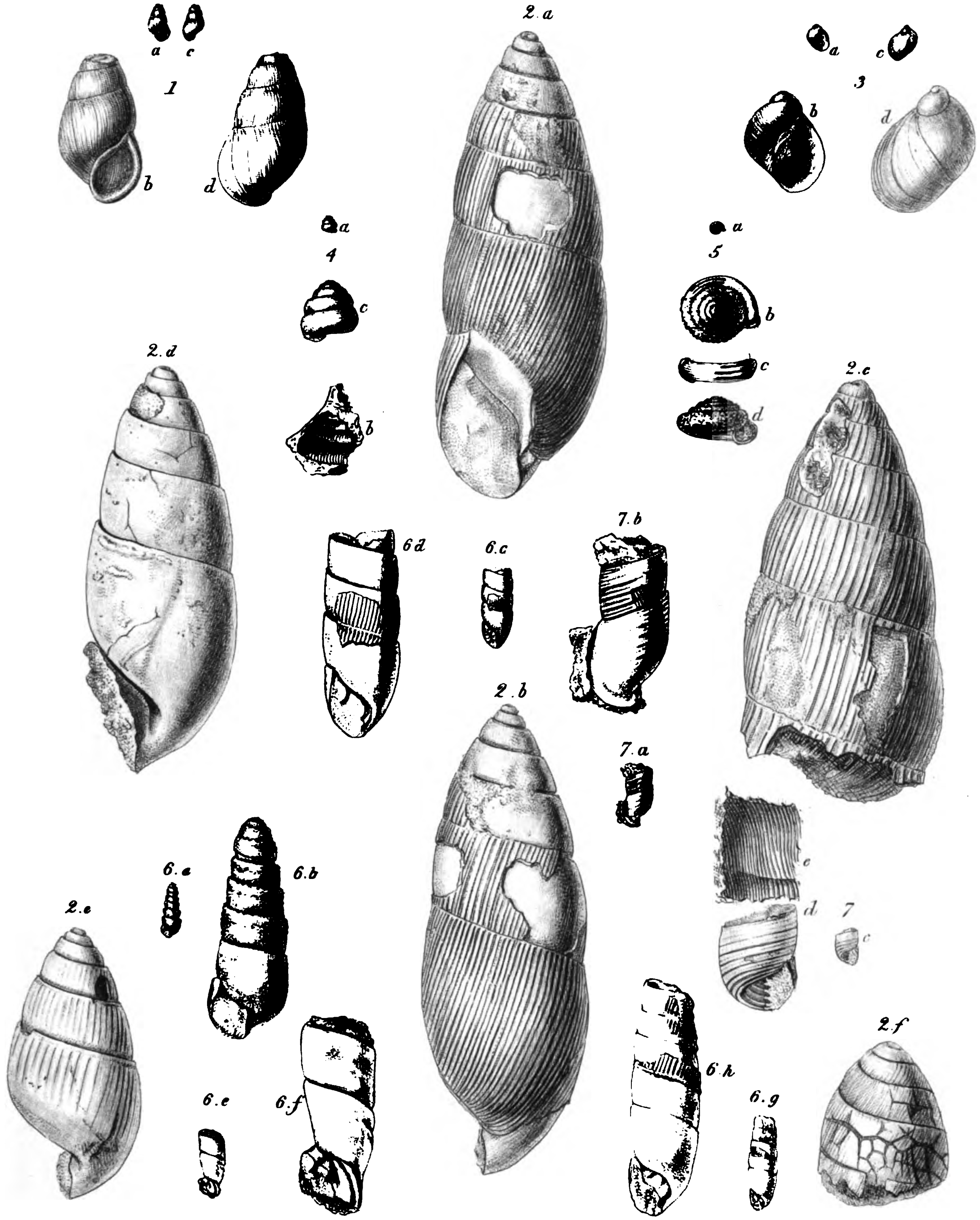
J. De C. Sowerby fecit.

## TAB. XI.

Fig.

1. Bulimus politus. No. 24, *p*. 73.
   - *a*. Front view, natural size.
   - *b*. Ditto, magnified.
   - *c*. Back view, natural size.
   - *d*. Ditto, magnified.
2. Bulimus ellipticus. No. 23, *p*. 72.
   - *a*. Front view
   - *b*. Side view.
   - *c*. Fragment of a large specimen in the Brit. Mus.
   - *d*. Side view of a cast.
   - *e*. Side view of a cast, young.
   - *f*. Fragment from Primrose Hill. (*B. tenuistriatus*, G. Sow.)
3. Succinea imperspicua. No. 29. *p*. 81.
   - *a*. Front view, natural size.
   - *b*. Ditto, magnified.
   - *c*. Back view, natural size.
   - *d*. Ditto, magnified.
4. Helix sub-labyrinthica. No. 21, *p*. 69.
   - *a*. Front view of a cast, natural size.
   - *b*. Impression of the whorl, magnified.
   - *c*. Back view, magnified.
5. Helix Headonensis. No. 22, *p*. 70.
   - *a*. Upper surface of a cast. Natural size.
   - *b*. Ditto, ditto, magnified.
   - *c*. Portion of the whorl of ditto, magnified.
   - *d*. Front view of ditto, magnified.
6. Clausilia striatula. No. 28, *p*. 79.
   - *a*. Front view of a cast of a young shell, nat. size.
   - *b*. Ditto ditto, magnified.
   - *c*. Front view of cast with parts of the shell preserved, nat. size.
   - *d*. Ditto, ditto, magnified.
   - *e* and *g*. Views of casts of adult shells, showing the aperture, nat. size.
   - *f* and *h*. Ditto ditto, magnified.
7. Pupa perdendata. No. 26, p. 77.
   - *a*. Back view of a cast (shell partly preserved), natural size.
   - *b*. Ditto ditto, magnified.
   - *c*. Front view of ditto, natural size.
   - *d*. Ditto ditto, magnified.
   - *e*. Impression of the whorls in the matrix, magnified.

Tab. XI.



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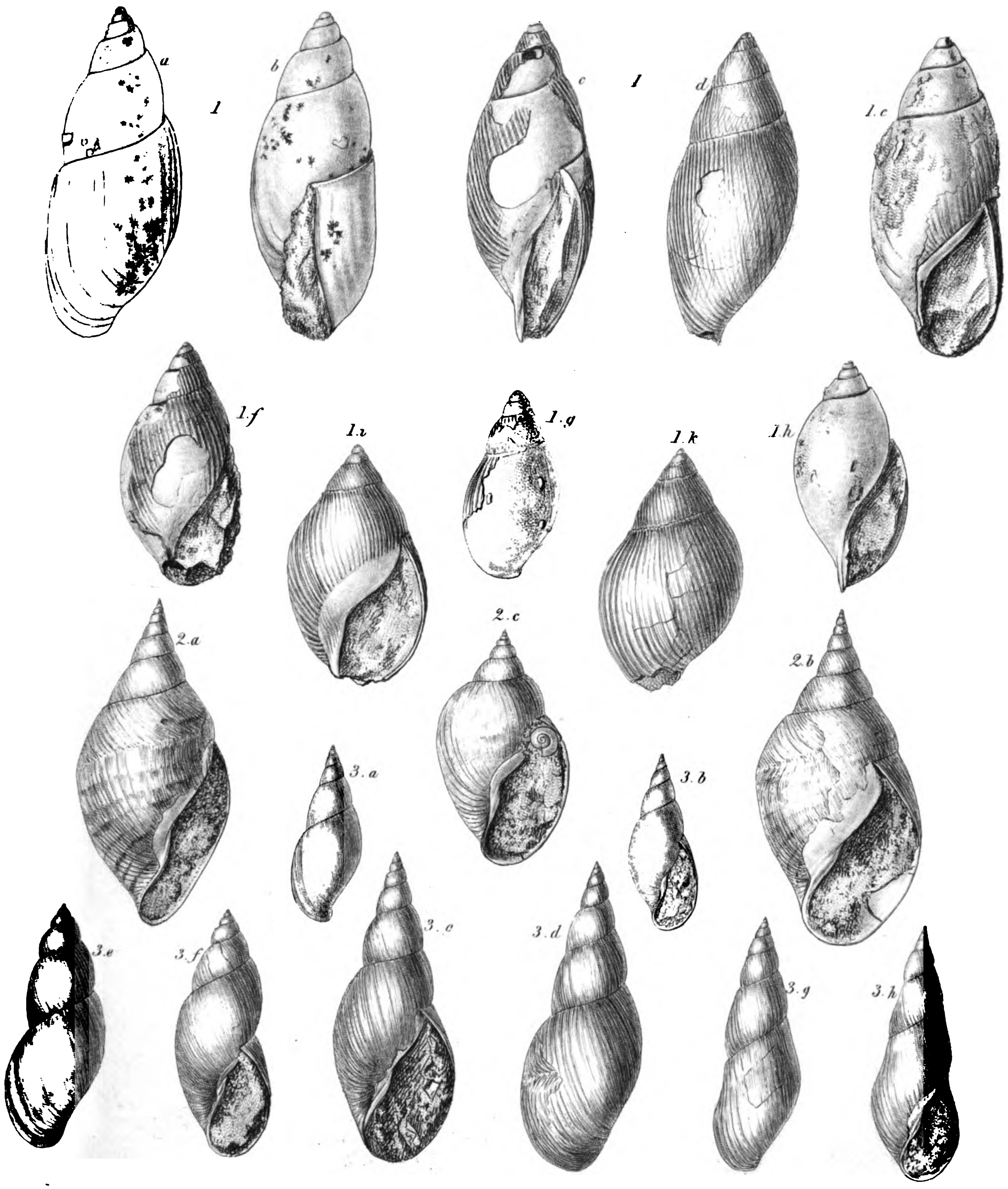
## TAB. XII.

Fig.
1. Achatina costellata. No. 25, *p.* 75.
    - *a.* Back view of a cast.
    - *b.* Side view of ditto.
    - *c.* Front view of a specimen with the shell partly preserved.
    - *d.* Back view of ditto.
    - *e.* Front view of a cast.
    - *f.* Ditto of ditto, shell partly preserved. Young shell.
    - *g.* Back view of a cast of a young shell.
    - *h.* Front view of ditto.
    - *i.* Back view, var. *abbreviata.*
    - *k.* Front view, ditto.

2. Limnæa caudata. No. 30, *p.* 83.
    - *a.* Side view.
    - *b.* Front view.
    - *c.* Ditto, var. *abbreviata.*

3. Limnæa longiscata. No. 32, *p.* 85.
    - *a.* Back view, intermediate state of growth.
    - *b.* Front view, ditto.
    - *c.* Front view, adult shell.
    - *d.* Back view, ditto.
    - *e* and *g.* Back views, var. *distorta.*
    - *f* and *h.* Front views, ditto.

Tab. XII.



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## TAB. XIII.

Fig.

1. Limnæa subquadrata. No. 41, *p*. 92.
   - *a*. Front view.
   - *b*. Back view.

2 and 3. Limnæa pyramidalis. No. 31, *p*. 84.
   - *a*, *a*. Front views.
   - *b*, *b*. Back views.

4. Limnæa sublata. No. 35, *p*. 88.
   - *a*. Side view.
   - *b*. Front view.

5. Limnæa mixta. No. 36, *p*. 88.
   - *a*. Front view.
   - *b*. Back view.

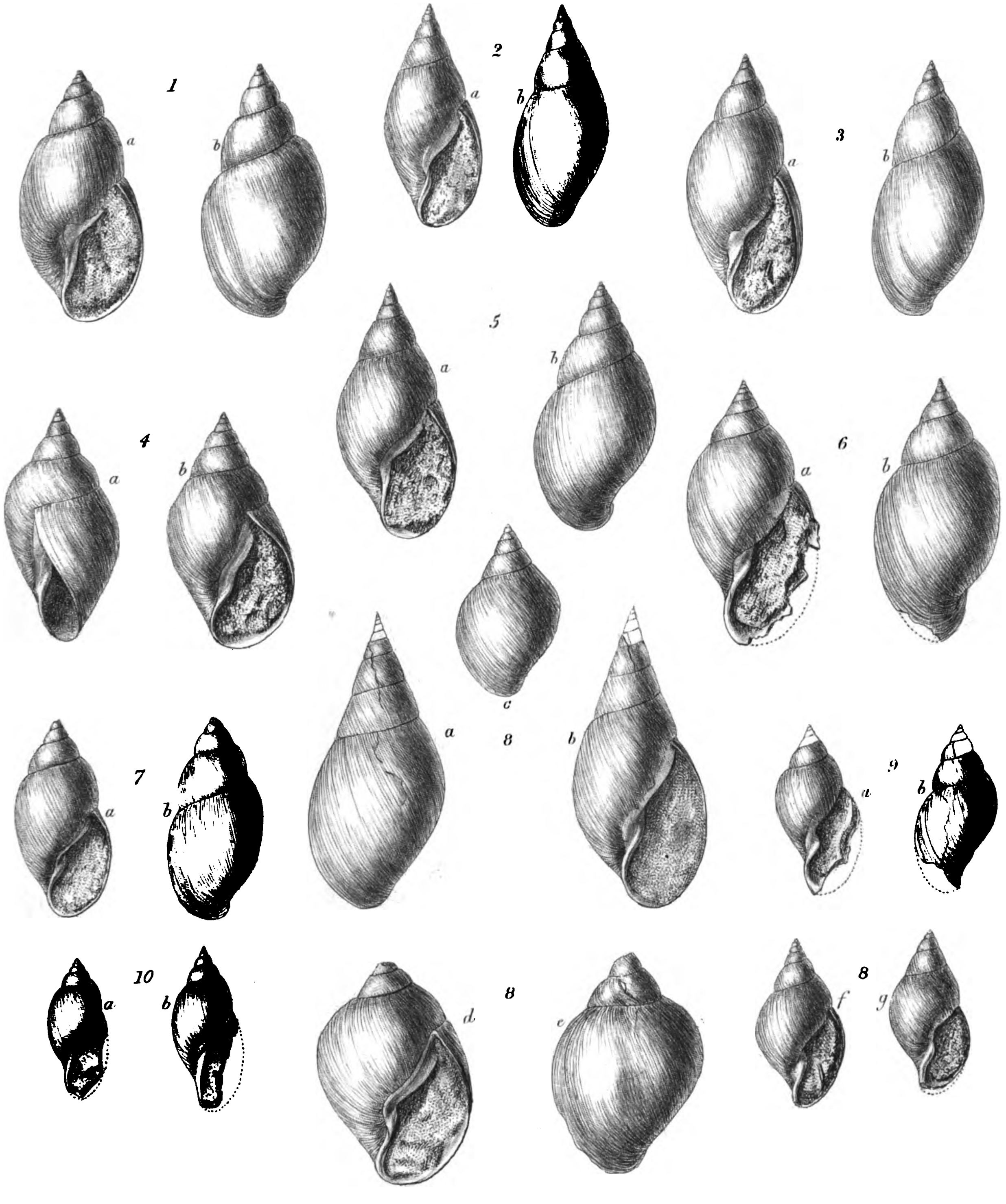
6. Limnæa tumida. No. 39, *p*. 91.
   - *a*. Front view.
   - *b*. Back view.

7. Limnæa convexa. No. 42, *p*. 92.
   - *a*. Front view.
   - *b*. Back view.

8. Limnæa fusiformis. No. 38, *p*. 90.
   - *a*. Back view of specimen from Headon Hill.
   - *b*. Front view, ditto.
   - *c*. Back view of ditto. Var. *deformis*, intermediate size.
   - *d*. Front view of ditto ditto adult shell.
   - *e*. Back view of ditto ditto ditto
   - *f*, *g*. Front views of shells from Sconce. Intermediate stage of growth.

9. Limnæa columellaris. No. 40, *p*. 91.
   - *a*. Front view.
   - *b*. Back view.

10. Limnæa costellata. No. 43, *p*. 93.
   - *a* and *b*. Front views.



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## TAB. XIV.

Fig.
1. Bulimus heterostomus. No. 70, *p.* 119.
    - *a.* Front view of a cast, nat. size.
    - *b.* Ditto, magnified.
    - *c.* Side view of ditto of the aperture, magnified.
    - *d.* Impression of the whorls in the matrix, magnified.

2. Velletia elegans. No. 64, *p.* 112.
    - *a.* View from above, nat. size.
    - *b.* Ditto, magnified.
    - *c.* Side view, ditto.
    - *d.* View of the aperture, ditto.

3. Pupa oryza. No. 27, *p.* 78.
    - *a.* Side view, nat. size.
    - *b.* Ditto, magnified.

4. Limnæa sulcata. No. 33, *p.* 87.
    - *a.* Front view.
    - *b.* Back view.

5. Limnæa cincta. No. 45, *p.* 94.
    - *a.* Front view.
    - *b.* Back view.

6. Limnæa angusta. No. 46, *p.* 95.
    - *a.* Front view.
    - *b.* Back view.

7. Limnæa recta, No. 49, *p.* 96.
    - *a.* Front view.
    - *b.* Back view.

8. Limnæa gibbosula. No. 34, *p.* 87.
    - *a* and *b.* Front views.
    - *c.* Back view.

Fig.
9. Limnæa minima. No. 48, *p.* 96.
    *a.* Back view, nat. size.
    *b.* Front view, magnified.
    *c.* Back view, ditto.

10. Limnæa fabulum. No. 44, *p.* 93.
    *a.* Front view.
    *b.* Back view.

11. Limnæa tenuis. No. 50, *p.* 97.
    *a.* Front view.
    *b.* Back view.

12. Limnæa ovum? No. 37, *p.* 89.
    *a.* Front view.
    *b.* Back view.

13. Limnæa arenularia. No. 47, *p.* 95.
    *a.* Front view.
    *b.* Back view.

14. Craspedopoma Elizabethæ. No. 69, *p.* 118.
    *a.* Front view, nat size.
    *b.* Ditto, magnified.
    *c.* Impression in the matrix, magnified.
    *d.* View of the base ditto.

15. Ancylus? latus. No. 63, *p.* 110.
    *a.* Side view, nat. size.
    *b.* View from above, magnified.

Tab. XIV.

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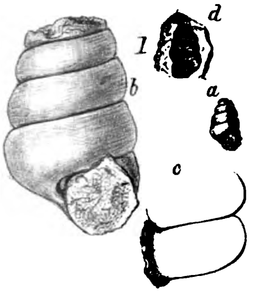

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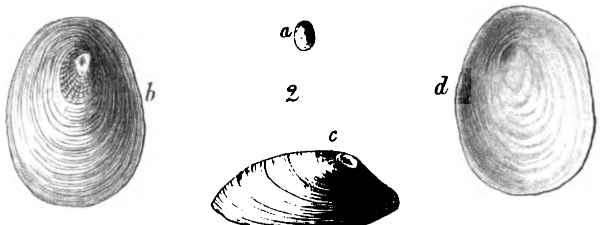

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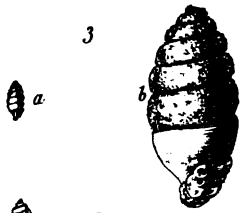

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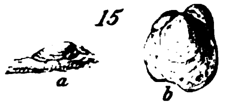

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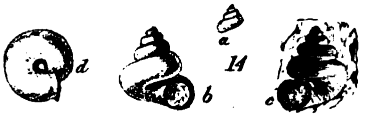

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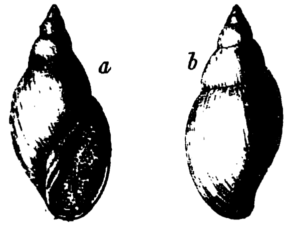

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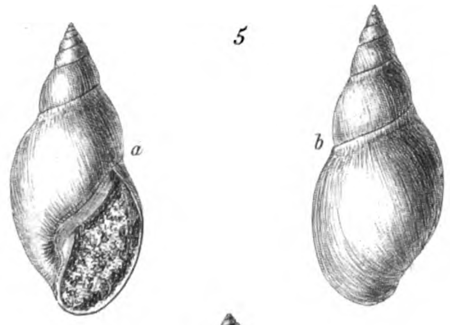

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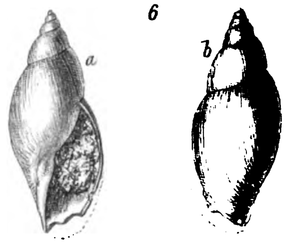

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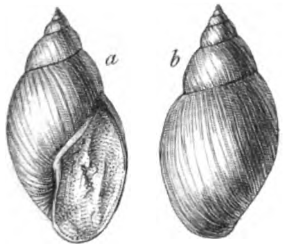

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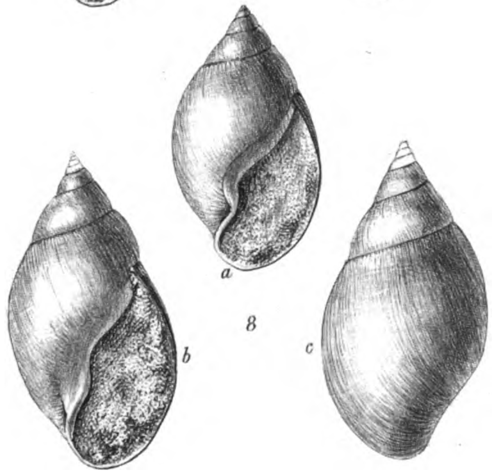

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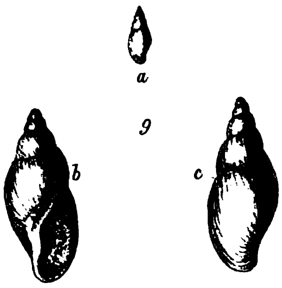

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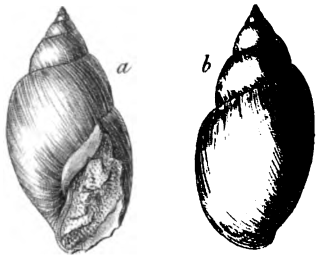

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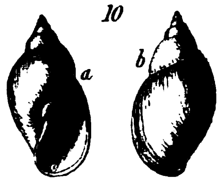

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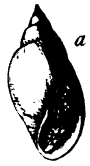

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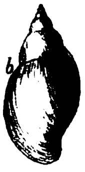

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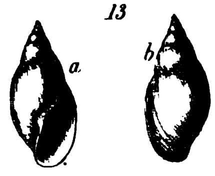

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## TAB. XV.

Fig.

1. Planorbis obtusus. No. 53, *p*. 102.
    - *a*. View of the upper disc (distorted specimen).
    - *b*. Side view.
    - *c*. Ditto (distorted specimen).
    - *d*. View of the under disc.
    - *e*. View of the upper disc.
2. Planorbis platystoma. No. 56, *p*. 103.
    - *a*. View of the upper disc, nat. size.
    - *b*. View of the under disc, magnified.
    - *c*. View of the upper disc ditto.
    - *d*. View of the aperture ditto.
3. Planorbis oligyratus. No. 55, *p*. 103.
    - *a*, *b*. Views of the aperture.
    - *c*. View of the under disc.
    - *d*. View of the upper disc.
    - *e*. View of the under disc of a cast.
4. Planorbis rotundatus. No. 52, *p*. 100.
    - *a*. Side view showing the aperture.
    - *b*. View of the under disc.
    - *c*. View of the upper disc.
5. Planorbis euomphalus. No. 51, *p*. 99.
    - *a*. View of the upper disc. Young shell.
    - *b*. Ditto ditto ditto.
    - *c*. Side view, showing the aperture in ditto.
    - *d*. View of the under disc of ditto.
6. Planorbis euomphalus. No. 51, *p*. 99.
    - *a*. Side view of adult shell.
    - *b*. View of the under disc of ditto.
    - *c*. View of the upper disc of ditto.
7. Planorbis discus. No. 54, *p*. 102.
    - *a*. View of the upper disc, with the shell preserved (intermediate stage of growth).
    - *b*. View of the under disc of a cast.
    - *c*. Side view of a cast.
    - *d*. View of the upper disc of a cast.

8. Planorbis lens. No. 57, *p.* 104.
    - *a.* View of the upper disc, nat. size.
    - *b.* Side view, magnified.
    - *c.* View of the under disc, ditto.
    - *d.* View of the upper disc, ditto.

9. Planorbis Sowerbyi. No. 62, *p.* 108.
    - *a.* View of the upper disc of a cast, nat. size.
    - *b.* Ditto ditto magnified.
    - *c.* Side view of ditto, showing the aperture, ditto.
    - *d.* View of the under disc of ditto, magnified.

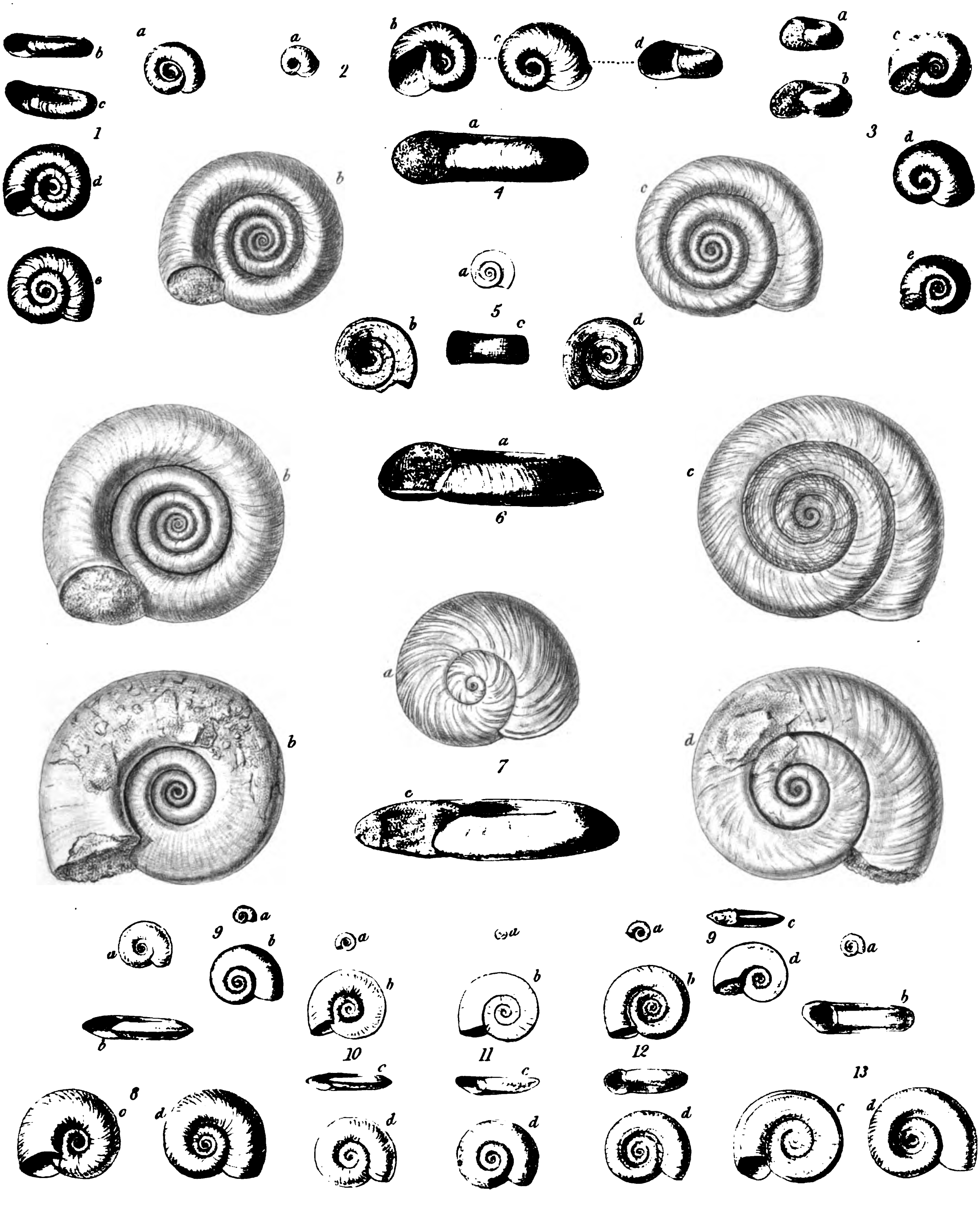
10. Planorbis tropis. No. 58, *p.* 106.
    - *a.* View of the under disc, nat. size.
    - *b.* Ditto ditto magnified.
    - *c.* Side view of ditto ditto.
    - *d.* View of the upper disc ditto.

11. Planorbis hemistoma. No. 59, *p.* 106.
    - *a.* View of the under disc, nat. size.
    - *b.* Ditto ditto magnified.
    - *c.* Side view of ditto ditto.
    - *d.* View of the upper disc ditto.

12. Planorbis elegans. No. 60, *p.* 107.
    - *a.* View of the under disc, nat. size.
    - *b.* Ditto ditto magnified.
    - *c.* Side view of ditto ditto.
    - *d.* View of the upper disc ditto.

13. Planorbis biangulatus. No. 61, *p.* 108.
    - *a.* View of the upper disc, nat. size.
    - *b.* Side view of ditto magnified.
    - *c.* View of the under disc ditto.
    - *d.* View of the upper disc ditto.

Tab. XV.



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THE

London, Eng.

# PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

LONDON:

MDCCCLIV.

A MONOGRAPH

OF

# THE EOCENE MOLLUSCA,

OR

DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES
OF ENGLAND.

BY

FREDERIC E. EDWARDS.

## PART III.

## PROSOBRANCHIATA.

LONDON:
PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY
1854.

J. E. ADLARD, PRINTER, BARTHOLOMEW CLOSE.

extremities, and although they are generally regular in form, as I have already stated, yet specimens occasionally occur more nearly spherical. The substance forming these casts is most frequently close and compact, like the rock in which they are embedded; sometimes, although rarely, the cavity is partially filled with matter, apparently the same as the matrix, but more granular, and sometimes crystalline, as if due to percolation.

I am aware that by some these substances are regarded as coprolitic;* that by others they are considered to be the remains of seed vessels; and, again, that by others their origin is attributed to the coccoons of insects; and I am desirous that the opinion I have expressed should be received as a *suggestion,* rather than as an induction from evidence which, it must be admitted, is inconclusive. As bearing, however, on the subject, and, if not supporting the view I have taken, at least presenting in some respects an analogy with the substances in question, I may refer to the instance of the eggs of

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### CORRIGENDA.

In the head-lines to sheets 17, 18, and 19, (p. 129, *et seq.*), *for* "Pulmonata," *read* "Prosobranchiata."
Page 126, line 10, *for* "Cypræa," *read* "Cypræ."
„ 133, „ 14, *for* "figs. 3 *a—d*," *read* "figs. 4 *a—c*."
„ 134, „ 27, *for* "Basingstoke," *read* "Cuffel, near Basingstoke."
„ 155, „ 28, *for* "(t. 25)," *read* "(t. 5.)"
„ 155, „ 30, after the word size, insert, "axis, 1 in. and $\frac{4}{10}$ths; diameter $\frac{6}{10}$ths of an inch."
„ 158, „ 14, *for* "figs. 4 *a—c*," *read* "figs. 4 *a—d*."
„ 160, „ last line but one; after axis, insert "2 inches, nearly;" and after diameter, insert, "1 in. and $\frac{1}{10}$th."
„ 168, „ 33, *for* "figs. 2 *a—b*," *read* "figs. 3 *a—b*."

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* With regard to the suggestion that these substances are coprolitic, it must be stated that the casts, some of which have been subjected by Mr. Morris to chemical analysis, do not present any trace of phosphate of lime; the presumption, therefore, is against their being coprolites of a carnivorous animal, and the constant regularity of their form, and the absence of carbonaceous matter, militate as strongly against the idea that they are fecal remains of an herbivorous animal.

† Lyell's 'Principles of Geology,' 9th edit., p. 77. Ansted's 'Geology,' vol. ii, p. 137.

J. E. ADLARD, PRINTER, BARTHOLOMEW CLOSE.

extremities, and although they are generally regular in form, as I have already stated, yet specimens occasionally occur more nearly spherical. The substance forming these casts is most frequently close and compact, like the rock in which they are embedded; sometimes, although rarely, the cavity is partially filled with matter, apparently the same as the matrix, but more granular, and sometimes crystalline, as if due to percolation.

I am aware that by some these substances are regarded as coprolitic;* that by others they are considered to be the remains of seed vessels; and, again, that by others their origin is attributed to the coccoons of insects; and I am desirous that the opinion I have expressed should be received as a *suggestion,* rather than as an induction from evidence which, it must be admitted, is inconclusive. As bearing, however, on the subject, and, if not supporting the view I have taken, at least presenting in some respects an analogy with the substances in question, I may refer to the instance of the eggs of turtles found on the shore of the Isle of Ascension, embedded in a recent limestone formed of sand, comminuted shells, and corals agglutinated together.† A small mass of this rock, enclosing several eggs, is in the Museum of the Geological Society of London; the cavities of the eggs are filled with the material forming the matrix, and, although the calcareous shell remains, we have only to imagine the eggs embedded under circumstances which would cause the dissolution and absorption of the calcareous matter, and some of the very conditions in which the substances in question are found would be exactly represented.

A series of these substances, showing the different sizes and forms, is represented by the woodcuts in the next page. Those most commonly found are represented by figs. 2, 3, 4, and 5; they present a close resemblance, both in size and shape, to the eggs of several of the recent fresh-water tortoises, and may be casts of eggs of some of the species of *Trionyx* or *Emys*, which lived in the Eocene rivers or marshes. Those represented by figs 8, 9, and 10, may be casts of some of the *Helicidæ*.

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* With regard to the suggestion that these substances are coprolitic, it must be stated that the casts, some of which have been subjected by Mr. Morris to chemical analysis, do not present any trace of phosphate of lime; the presumption, therefore, is against their being coprolites of a carnivorous animal, and the constant regularity of their form, and the absence of carbonaceous matter, militate as strongly against the idea that they are fecal remains of an herbivorous animal.

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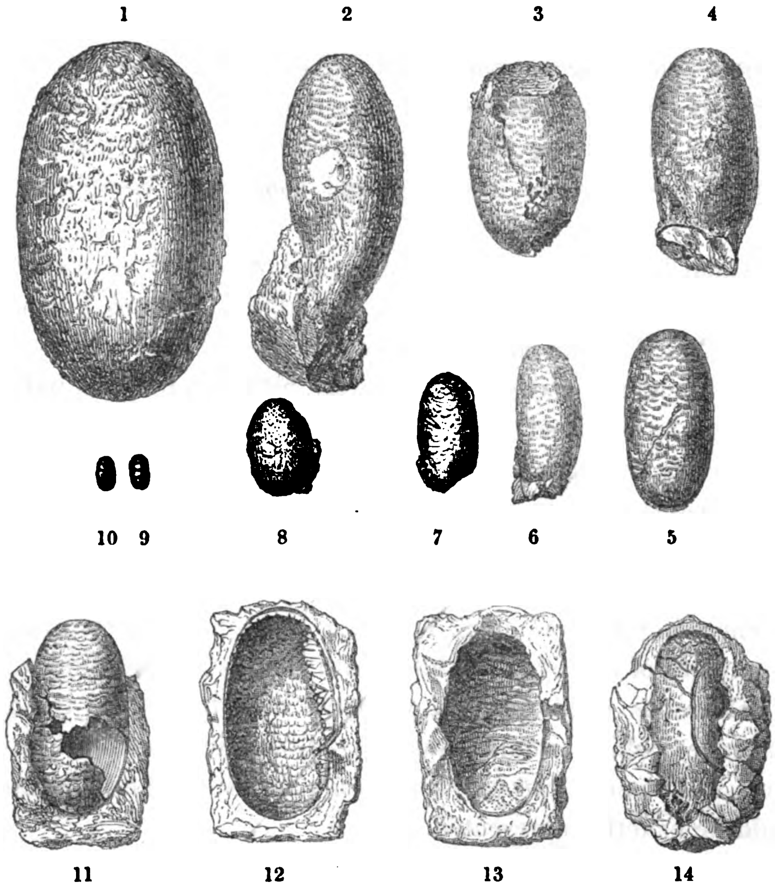

Fig. 1—10. Oviform substances of the different sizes found in the fresh-water limestone at Sconce, in the Isle of Wight.

„ 11. An oviform embedded entire, in which the outer covering has been absorbed and replaced by carbonate of lime; the cavity empty.

„ 12. An oviform in a condition similar to No. 11, excepting that the cavity is partly filled with crystals of carbonate of lime.

„ 13. The impression left in the matrix by an oviform embedded entire, the outer covering of which has been absorbed.

„ 14. The internal cast of an oviform of which the outer covering has been absorbed.

## ORDER—*PROSOBRANCHIATA.* M. EDWARDS.

PECTINIBRANCHIATA, *Cuvier.*
TUBULIBRANCHIATA, „
SCUTIBRANCHIATA, „
CYCLOBRANCHIATA, „
PARACEPHALOPHORA DIOICA, *De Blainville.*

To the free-air-breathing gasteropods succeed those which breathe, by means of gills, the air diffused through the water in which they live. In them the head is more or less fully developed, and the mouth is furnished with a riband-shaped tongue, armed with numerous series of teeth, which present great varieties of form and arrangement. In some cases the animals are hermaphrodite, the sexes being united in the same individual, but in by far the larger proportion the sexes are distinct; with very few exceptions, they are all oviparous. In the larva state they are always furnished with spiral shells, which, in some cases, as the animals approach maturity, become rudimentary or altogether disappear; but more generally the shells become largely developed, so as to contain the whole animals within them. The respiratory organs exhibit many differences in structure and position, and these varied conditions were adopted by Cuvier as ordinal distinctions in the systematic arrangement proposed by him. De Blainville, on the other hand, availed himself of the modifications in the reproductive apparatus, and divided his second class "*paracephalophora,*" into the sub-classes *dioica,* in which the male and female sexual organs are in different individuals, and *monoica,* in which the two sexes are united in the same individual. To these he added a third division, *hermaphrodita,* in which he described the generative apparatus as female only, a modification the existence of which subsequent investigation has disproved. It appears, however, by the observations of Milne Edwards, that the water-breathing gasteropods form two natural and well-defined divisions, which that eminent naturalist has called respectively, *opisthobranchiata* and *prosobranchiata,* from the position of the gills in relation to the heart.* In the first of these divisions, which corresponds with the *nudibranchiata, testibranchiata,* and *inferobranchiata* of Cuvier, and with the *monoica* and *hermaphrodita* of De Blainville, the respiration is effected by arborescent or fasciculated gills, which are not enclosed in a special cavity, but are more or less completely exposed, either on the back or on the sides towards the hinder part of the body. The reproductive apparatus is hermaphrodite (not in the sense used by De Blainville, but meaning that the sexes are united in the same individual), and the shell is either wanting or is merely rudimentary in the adult state. In the second division, the abdomen, which is developed proportionately with the cephalic and locomotive masses, is always protected by a shell, generally of sufficient size to contain the whole animal. The mantle forms over the cervical region a vaulted chamber, more or less capacious, in which the branchiæ are lodged and the excretory orifices are placed. The reproductive organs, male and female, are borne by different individuals. This division comprises Cuvier's four remaining orders of the *branchifera,* and corresponds with De Blainville's sub-class *dioica.* The branchiæ are composed of simple and parallel plates, arranged, somewhat like the teeth of a comb, along a vascular stem, and, for the most part, are placed obliquely across the back, or are attached to the right side of the neck.

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* Etym. *οπισθε* (in the after part, behind), and *προὼσον* vel *πρῶσον* (advanced, pushed forward), respectively prefixed to *βραγχια* (the gills).

In some genera in this order, the edge of the mantle is prolonged into a canal or siphon, which can be extended at pleasure, so as to permit the free passage of water into the branchial chamber, while the animal itself remains within the shell; and where this siphon exists, the front of the aperture of the shell presents a notch, or is produced into a channel in which the siphon rests. In other genera the respiratory siphon is altogether wanting, or its place is supplied by a lobe developed from the neck, and in these genera the aperture is without the anterior notch or channel. Sometimes a posterior tube exists with a corresponding notch or canal in the shell; but the function of this posterior tube is simply to provide for the more easy efflux of water or the ejection of the anal excretions from the branchial chamber. The head of the prosobranchiate gasteropod is provided with tentacles, which serve as organs of touch, and probably of smell, and with a proboscis which in some genera is retractile or exsertile. The eyes, with which organs all are endowed, are generally placed either at the bases, or on the extremities, or the sides of the tentacles; but in some genera they are carried on pedicels specially appropriated for them.

The presence or absence of the respiratory siphon has been used for the subdivision of the present order into two sections: 1st, *Siphonostomata,* corresponding with De Blainville's order *siphonobranchiata,* and comprising such of the prosobranchiata whose proboscis is retractile, and the margin of whose mantle is prolonged into a siphon, and whose shell is, consequently, notched or produced into a channel in front: and 2d, *Holostomata,* consisting of those in which the proboscis is not retractile, and the animal not being provided with a respiratory siphon, the aperture of the shell is entire. The genera comprised in the first section are all zoophagous, and are inhabitants of the sea or of brackish water; those in the 2d section are, for the most part, phytophagous; the greater number live in salt or brackish water; some, however, are inhabitants of fresh water. This subdivision, although very convenient, is not, as Mr. Woodward* remarks, altogether satisfactory; inasmuch as several genera occur among the *holostomata* in which the proboscis is retractile, or the shells are notched or furnished with an anterior canal.

By far the greater part of the present order are furnished with an operculum, but many are without that protection.

Since Lovén published the result of his examination of the dental apparatus of Mollusca, much attention has been paid to the subject, and great importance is attached to the condition of the lingual teeth. But the assistance derived from this character, however valuable it may prove to malacologists, can be available indirectly only to the palæontologist.

## *Family*—CYPRÆIDÆ.

### Genus 20th. CYPRÆA.† *Linn.* 1740.

PERIBOLUS, *Adanson*, 1757; *De Blainville*, 1825.
CYPRÆA, *Lamarck*, 1801; *De Blainville*, 1825.
CYPREA, *Montf.*, 1810.
COCCINELLA, *Leach*, 1820.
TRIVIA—CYPROVULA—LUPONIA, *Gray*, 1830.

*Gen. Char.*—Shell oviform, oblong or sub-globular, convolute, enamelled, generally smooth, sometimes pustulous, transversely ribbed, or cancellated: spire short, depressed visible only in the young state, when adult, concealed by the enamel; aperture long, narrow, terminating at each extremity in a short canal; outer lip inflected, crenulated; inner lip crenulated.

The animal of Cypræa has a broad, sub-lunate head, terminating in a short retractile muzzle, and bearing long subulate tentacles on bulgings, at the outer bases of which the eyes are placed. The foot is broad, truncated in front, pointed, and sometimes much produced behind; the mantle terminates in a siphon in front, and the lateral margins, as the animal approaches maturity, expand into lobes, generally equal, but frequently more or less unequal, and which can be extended at pleasure, so as entirely or nearly to cover the shell, the edges meeting on the back or on the right side, according as the lobes are equal or unequal. By these lobes is deposited the testaceous matter which forms the enamel-like covering of the shell, characteristic of the family; the line of juncture being usually indicated, in recent cowries, by a groove or a streak of a fainter colour. The outer surfaces of the lobes are generally covered with filaments, sometimes with numerous papillæ, and in some instances they are smooth. The branchial organ consists of a single plume, and the dental apparatus is composed of a series of rows of teeth, each row formed of one broad uncinated central tooth, and three hooked lateral teeth on each side.

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* 'A Manual of the Mollusca,' p. 122.
† Etym., from *Cypris*, one of the names of Venus.

In the young state, the Cowry presents a very different appearance to that which it ultimately assumes. In the early stage of growth the outer lip is thin, sharp, and simple, neither involute nor crenulated; the aperture is wide and effuse in front, and the spire is well-marked. In this state the shell is quite smooth, and without the enamel and coloration which subsequently form its chief beauty.

Various generic divisions of the Cypræa have been proposed by different authors; but they appear to depend mainly on conchological distinctions, the animals, in so far as they are at present known, not presenting essential differences from the true Cypræa; and these genera, therefore, are more usually regarded as sections merely of the present genus. A slight variation in the dental apparatus, and the papillose surface of the lobes appear to distinguish the genus *Trivia*,* the only section of the present genus which is represented in our Eocene Fauna.

As a genus, the living Cowries have a wide range, extending from the shores of Greenland to the equator. The largest and most beautiful species are, however, inhabitants of the tropical seas, where they are found in shallows under coral-reefs or rocks. Upwards of 150 species have been figured and described; of these one species only (*Cyp. Europæa*), is found on our coasts.

In the fossil state, a few species, referred to this genus, from the upper cretaceous formations in Pondicherry, at Martignes (Bas du Rhone), and at Faxoè, in Denmark, have been described by Professor E. Forbes, Matheron, and Sir C. Lyell; but in the eocene and subsequent formations, the genus has a much larger development. From the lower and middle beds of the Paris Basin, twelve species have been described by Lamarck, Deshayes, and Melleville; from the miocene and more recent beds of Touraine, Dax, and Bourdeaux, and the pleiocene formations of Piedmont and Turin nearly seventy species have been described by Dujardin, Grateloup, Brocchi, Basterot, Sismonda, and others; and from the Crag of England, and the synchronous deposits in Belgium, several other species have been described by MM. Sowerby, Searles Wood, Nyst, and Philippi. Of the English eocene Cyprææ, five species only have hitherto been described; to these I now add four new species, three of which belong to the section *Trivia*.

### No. 71. Cypræa inflata. *Lamarck*. Tab. XVI, fig. 4*a*, *b*.

Cypræa inflata, *Burtin*. 1784. Oryct. de Bruxelles, t. 17. fig. T.
— — *Lamk*. 1802. Ann. du Mus., vol. ii, p. 389, No. 2, vol. vi, t. 44, fig. 1.

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* Messrs. Adams' 'Genera of Recent Moll.,' vol. i, p. 264.

CYPRÆA INFLATA, *Lamk.* 1822. Hist. nat., vol. vii, p. 407, No. 11.
— — *Brogn.* 1823. Sur les terr. tert. &c. du Vicent. p. 62.
— — *Defr.* 1826. Dict. des Sci. nat., vol. xliii, p. 35.
— — *Bronn.* 1831. Ital. Tertiargeb. &c., p. 15, No. 33.
— — *Gray.* 1832. (Add. to Mon. Cyp.). Zool. Journ., vol. iv, p. 76, No. 30.
— — *Desh.* 1824—37. Desc. des Coq. foss., &c., vol. ii, p. 724; t. 97, figs, 7, 8.
— — ? *Galeotti.* 1837. Mém. sur la const. géog. &c. de Brab., p. 148, No. 69.
— OVIFORMIS, ? *Galeotti.* 1837. Mém. sur la const. géog. &c. de Brab., p. 183, No. 12.
— INFLATA, ? *Nyst.* 1843. Coq. &c., de Belg., p. 607.
— — *Sowerby.* 1850. Dixon's Geol. &c. Suss., p. 108, t. 8, figs. 4-5.

*C. testá ovatá, inflatá, anticè attenuatá, posticè sub-obtusá, lævi: aperturá elongatá, angustá, flexuosá, basi dilatatá, vix emarginatá; columellá obsoletè plicato-dentatá; labro incrassato, extùs sub-marginato, intus regulariter dentato, anticè compresso.*

Shell ovate, ventricose, swelled out in the middle, attenuated in front, rather obtuse behind, smooth: aperture elongated, curved, narrow, but somewhat wider in front, where it terminates in a short wide canal, obscurely notched. The outer lip much produced, and the posterior extremity bent suddenly towards the apex of the spire, forming between it and the posterior extremity of the body-whorl, an oblique narrow groove, which represents the posterior canal found in some of the Cypræœ; the outer lip thickened, depressed on the surface, flattened in front on the inner surface, where it joins the anterior canal, and presenting a prominent ridge along the outer margin; the teeth, which are short and placed on the inner edge only, become obsolete on the flattened part of the lip. The columella presents four or five oblique folds in front, and is obscurely dentated behind.

This Cypræa occurs rather numerously in the *calcaire grossier;* our English specimens are generally of a larger size than those found in the French formations.

*Size.*—Axis, 1 inch and 5-10ths, nearly; diameter, 1 inch: occasionally larger specimens occur.

*Localities.*—Bracklesham Bay, where it is common; but the specimens are generally distorted. *French:* Grignon, Parnes, Mouchy, Amblainville, Thury-sous-Chaumont, (fide D'Orb.) The species is recorded by Brogniart and by Bronn as occurring at Ronca (Vicent.) but the identity is questionable. Casts of Cypræœ occur in the sands of Rouge-Cloître, St. Josse-ten Noode, Groenendael and Orp-le-Grand, in Belgium, which also have been referred, although with doubt, to the present species. The shells from Dax and St. Paul, which were described by Grateloup as belonging to *C. inflata,* appear to belong to a distinct species, which D'Orbigny has named *C. pseudo-inflata;* and the shells from the Piacentin, referred by Brocchi to this species, also appear to be distinct, and have been described by Sismonda under the name *C. labrosa.*

### No. 71*. Cypræa oviformis. *Sowerby.* Tab. XVI, f. 1*a*—*i*.

Cypræa oviformis, *Sow.* 1812. Min. Con., vol. i, p. 17, t. 4, 3 lower fig.
— — *Defr.* 1826. Dict. des Sci. nat., vol. xliii, p. 40.
Ovulum retusum, *Sow.* 1834. (Wetherell on Hampstead Heath Well,) Geol. Trans., 2d. Series, vol. v, p. 136, t. 8, fig. 19.
Non Cypræa oviformis, *Galeotti.* 1837. Mém. sur la const. géog. &c. de Brab., p, 183, No. 12.

*C. testá sub-globosá, anticè attenuatá, lævi: aperturá posticè elongatá, flexuosá, angustissimá, anticè latiori, extremitatibus canaliculatá, ad basin emarginatá; labro posticè et in medio compresso et incrassato, anticè acuto, expanso, extus marginato, intus regulariter dentato; labio anticè compresso, in callum fastigiosum ad basin tendentem lateraliter expanso; columellá planulatá, anticè concavá, dentato-plicatá.*

Shell sub-globose, narrowing gently towards the base, where it is produced into a short wide beak or canal, slightly notched in front, smooth: aperture elongated, curved, very narrow, but expanding a little before it enters the anterior canal; the outer lip prolonged at the posterior extremity, thickened; compressed until nearly opposite the wide part of the aperture, where it becomes thin and elevated, and is flattened on the inner surface; a narrow raised border, more or less prominent in different individuals, runs along the outer margin, and joins the thin elevated part of the lip. The teeth are numerous, short, not extending beyond the inner margin, and almost obsolete on the anterior part of the lip. The inner lip, towards the front, expands into a narrow ridge-like prominence, which extends to the very base; and at the posterior extremity rises into an angular callus, forming the left wall of the posterior canal. The columella is flattened, hollowed towards the front, and covered with numerous slender pliciform teeth.

The projecting margins, imparting to the front of the aperture the resemblance of a wide trough, form a character by no means common among the Cyprææ; it is found, although not so prominently, in *C. exerta* (Desh.), a species from the *sables inférieurs* of the Paris Basin, and in the English *C. Bartonensis.* A short and very globose variety (fig. 1*d*) occurs at Whetstone, in which the projecting margins are farther apart, and the trough, consequently, is wider than in the type. The specimen figured, which is from Mr. Wetherell's collection, has lost part of the anterior canal.

In the young state, this Cypræa is almost pyriform, being much more produced and attenuated in front; and it is covered with very numerous transverse raised lines, traversed by sharp, perspicuous lines of growth; the aperture is much lengthened and curved at the posterior extremity, wide, and very effuse in front, and the columella is twisted. In this state it has the appearance of an Ovula, and, in fact, an immature individual of the species obtained by Mr. Wetherell, from the well sunk at the Lower Heath, Hampstead, has been described by Mr. Sowerby as *Ovulum retusum.* A selection from the beautiful series of specimens in Mr. Wetherell's cabinet, with the aid of some specimens in my own collection, enables me to show that the *Ovulum retusum* is, as I have stated, only the young shell of the present species. The shells represented by fig. 1*e*, 1*f*, and 1*i*, are young Cypræe, in the first stage of growth, without teeth on either lip, and before the outer lip has become involute, but presenting the transverse lineation of the so-called *Ovulum retusum*, fig. 1*i*, being, in fact, taken from one of the original specimens so described. In the next specimen, fig. 1*g*, the shell has apparently attained the second or intermediate stage, the columellar teeth having been formed, and the lateral expansion of the left lip having commenced; and we find these characters associated with the transverse lineation. The specimen, fig. 1*h*, is a fully formed shell of *C. oviformis*, in which, a portion of the shell having been broken away, the interior volutions, exhibiting the transverse lineation, are disclosed.

*Size.*—Axis, 1 inch and 3-10ths; diameter, 1 inch.

*Localities.*—Primrose Hill, Highgate, Hampstead, Haverstock Hill, Copenhagen Fields; Barnet, Whetstone, Potter's Bar, Sheppey.

### No. 72. CYPRÆA BOWERBANKII. *Sowerby.* Tab. XVII, fig. 1*a*—*d*.

CYPRÆA OVIFORMIS, *Sow.* (1812.) Min. Con., vol. i, p. 17; t. 4, upper fig.
— BOWERBANKII, *Sow.* (1850.) Dixon's Geol. &c., Suss., pp. 108 and 189, t. 8, figs. 1 and 2.

*C. testâ oviformi, ventricosâ, lævi: aperturâ angustâ, arcuatâ, anticè sub-effusâ, latè emarginatâ; labro inflexo, marginato, posticè producto, anticè compresso, dentato-plicato, dentibus anterioribus elongatis; columellâ dentatâ, dentibus anticis pliciformibus; denti primâ magnâ, proeminenti, rotundatâ.*

Shell egg-shaped, ventricose, smooth: aperture curved, narrow, effuse in front, without a posterior canal, and widely but not deeply notched at the base; outer lip incurved, produced posteriorly, flattened towards the front; teeth on the flat part elongated, oblique; the anterior tooth on the columella large, round, prominent, and very oblique.

The specimen represented by fig. 1*a* and 1*b*, and for the use of which I am indebted to Mr. Sowerby, is the Highgate shell, from which the upper figure in tab. 4 of 'Mineral Conchology,' was taken; it has not attained maturity, the teeth not being formed on the outer lip. It will be seen that the aperture in fig. 1*b* is wider in front than that in fig. 1*d*, which is taken from a fully grown shell: this difference is to be attributed partly to the immature state of the outer lip of the specimen, and partly to the front of the columella being represented with a curve too deep. In other respects the Highgate shell agrees with those from Bracklesham Bay. The figs. 1*c* and 1*d*, are taken from specimens which form part of the late Mr. Dixon's collection.

According to the strict rules of nomenclature, the specific name *oviformis* ought, perhaps, to be retained for this shell; but the species which occurs not unfrequently at Highgate and the neighbouring localities, and which is figured on the same plate, is so generally known as *C. oviformis*, that I have applied the name to that species.

*Size.*—Axis, 3 inches and 1-10th; diameter, 2 inches and 2-10ths.

*Localities.*—Highgate, where it is very rare; Bracklesham Bay, where it is not uncommon.

### No. 73. CYPRÆA GLOBULARIS. *F. E. Edwards.* Tab. XVI, fig. 3*a*, *b*.

CYPRÆA GLOBOSA, *J. Sow.* 1850. Dixon's Geol., &c., Sussex; p. 189, t. 8, fig. 3.

*C. testá globosá, lævi, anticè rostratá, vix emarginatá; aperturá sub-rectá, angustá, posticè sub-canaliculatá; labro inflexo, compresso, intús dentato, dentibus numerosis, ferè equalibus; columellá dentato-plicatá, anticè compressá.*

Shell globose, smooth, with a short, straight, rather narrow canal; scarcely notched in front; aperture nearly straight, narrow, terminating posteriorly in an obscure canal; outer lip broad, compressed, curved inwards, with numerous regular teeth, nearly equal in size, placed on the inner edge; columella furnished with numerous pliciform teeth.

The nearly globular form and short narrow beak of this exceedingly rare Cypræa distinguish it from all its congeners. The specimen from which the figures are taken forms part of Mr. Dixon's collection, and is, I believe, unique. The specific name proposed by Mr. Sowerby having been previously used by Dujardin for a different species from the Faluns of Touraine, I have substituted the present name for it.

*Size.*—Axis, nearly 2 inches; diameter, 1½ inch.

*Locality.*—Bracklesham Bay.

### No. 74. CYPRÆA BARTONENSIS. *F. E. Edwards.* Tab. XVII, fig. 6*a*—*b*.

*C. testá ovatá, ventricosá, subtús depressiusculá, anticè attenuatá, lævi; spirá prominulá, vix obtectá, sulco obscuro circumdatá: aperturá lineari, angustissimá, anticè latiori, posticè elongatá, utráque extremitate sub-rostratá et emarginatá; labro extus marginato, anticè compresso, regulariter dentato; columellá subrectá, planulatá, anticè concavá, dentato-plicatá, dentibus posticis elongatis.*

Shell ovate, ventricose, flattened beneath, attenuated in front, rather obtuse behind; spire somewhat elevated, scarcely concealed by the enamel, and encircled by an obscure sulcus formed by the suture: mouth nearly straight, very narrow, a little wider in front, produced behind, and presenting at each extremity a short canal, slightly notched; outer lip broad, thickened, so as to form a curved raised border along the outer margin, flattened towards the base, and furnished with numerous regular teeth, of which the posterior ones are pliciform. The anterior canal is defined by an obscure, nearly vertical plait on the outer lip, and a curved elevated plait at the base of the columella; inner lip thickened, and spread out at the base, forming a prominent callus towards the front of the whorl, plicated along the whole length on the inner margin, and produced at the posterior extremity into a bluntly pointed projection which forms the left wall of the posterior canal. Columella nearly straight, flattened, and presenting towards the front end, a deep three-sided concavity connected with the body whorl by a short, wide depression; columellar teeth pliciform, the posterior ones longer and more oblique than the others.

This species, the prettiest of the English Eocene cowries, resembles *C. media*, (Desh.) more closely, perhaps, than any other of the fossil Cypræææ; but the elevated spire, the anterior callus, and the strongly marked posterior canal impart to it a distinct character.

*Size.*—Axis, rather more than 1 inch: diameter, 7-10ths of an inch nearly.

*Locality.*—Barton, where it is not very common.

No. 75. CYPRÆA TUBERCULOSA. *Duclos.* Var. COOMBII. *Sowerby.* Tab. XVI, fig. 2, Tab. XVII, fig. 5.

OVULA TUBERCULOSA, *Duclos.*

CYPRÆA DESHAYESII, *Gray.* (1832). (Add. to Mon. Cypr.,) Zool. Journ., vol. iv, p. 83, No. 64*.

— — *G. Sow.* (1832). (Notes on Gray's Additions to Mon. Cypr.,) Zool. Journ., vol. iv, p. 221.

OVULA TUBERCULOSA, *Desh.* (1824-37). Desc. des coq. foss, &c., vol. ii, p. 717, t. 96, fig. 16, t. 97, fig. 17.

— — *Desh.* (1844). 2d edit. Lam. Hist. nat., vol. x, p. 478, No. 3.

CYPRÆA COOMBII, *J. Sow.* (1850). Dixon's Geol. &c., Sussex, pp. 108 and 188, t. 8, fig. 6.

OVULA TUBERCULOSA, *D'Orb.* (1852). Podrome de Paléont., vol. ii, p. 314, No. 297.

*C. testâ magnâ, trigonâ, ventricosâ, lævi, dorso aliquando tuberculatâ, subtus planulatâ: aperturâ elongatâ, angustissimâ, ferè edentulâ, arcuatâ, anticè latiori, utrâque extremitate canaliculatâ; canali posteriori ad spiram reflexo, canali anteriori recto: labro compresso posticè exserto, sub-auriculiformi, lateraliter expanso.*

Shell large, trigonal, ventricose, smooth, sometimes presenting one or two tubercles on the back; base flattened, posterior end very broad, flattened, almost truncated: aperture elongated, curved, very narrow, rather wider in front, nearly if not altogether toothless, with a wide canal at each extremity; the anterior canal straight, the posterior one curved and bent upwards towards the spire; outer lip broad-edged, expanding at the posterior extremity into an ear-shaped projection.

The French specimens of the *Cypræa tuberculosa* are smaller and less triangular in form than our English shells; and the flattened posterior extremity is circumscribed by two lateral callosities which rise, one on each side, towards the back. This singular character, which forms a prominent feature in the specimen figured by M. Deshayes, and which I am assured by that gentleman is constant in the French shells, is wanting in the very few English specimens I have seen. Notwithstanding these differences, the English shells present such close affinities to the French specimens, that they must be regarded rather as a strongly marked local variety than as a distinct species. The dorsal tubercles, from which the specific name is taken, are stated by Mr. Sowerby not to be a constant character; they certainly appear to vary much in size and position, for in the figure and description given by M. Deshayes they are represented as of considerable size, and as ranged longitudinally about the middle of the shell; while in Duclos's original figure, they appear to be much smaller, and are placed transversely near the posterior extremity. The English specimen now figured, presents an even surface; but one, formerly in Mr. Bowerbank's museum, and which, unfortunately, has fallen to pieces, had a single large tubercle near the middle.

With regard to the genus to which this singular shell should be referred, a difference of opinion exists. The absence, or nearly obsolete condition, of the columellar teeth would seem to require that it should be placed, as in fact all the French authors have placed it, among the *Ovulæ;* but the pyriform shape, the aperture, and the general aspect of the shell belong rather to *Cypræa.* Dr. Gray has pointed out the analogy between it and the tuberculated variety of the recent *C. mus,* and asserting in fact, that M. Deshayes's specimen has a very few obscure teeth on the lips, he has stated that, in his opinion, the shell is evidently a cowry, an opinion from which Mr. George Sowerby has not dissented. On this authority, I have retained the shell in the present genus, of which, as Mr. James Sowerby has suggested, it may form with *C. mus,* a sub-genus.

*Size.*—Axis, 6 inches and 6-10ths; diameter, 5 inches.

*Localities.*—Bracklesham Bay, where it is rare. *French:* Rétheuil, Cuise-Lamotte, Pierrefonds, (Oise), (fide D'Orb).

### *Section*—TRIVIA.

### No. 76. CYPRÆA PLATYSTOMA. *F. E. Edwards.* Tab. XVII, fig. 7*a*—*f.*

*C. testâ parvâ, ovato-oblongâ, ventricosâ, anticè attenuatâ, transversim lineatâ, apice elevato; lineis angulosis, numerosis, regularibus, sulco dorsali perspicuo, mediano, interruptis; spatiis inter lineas concavis; aperturâ latâ, posticè sub-productâ, flexuosâ, canaliculatâ, anticè brevi latoque canali exeunti, vix emarginatâ; labro extùs late marginato, in medio leviter arcuato.*

Shell small, ovately oblong, ventricose, attenuated in front, almost pyriform; transversely ridged; apex elevated; ridges slender, sharp-edged, numerous, (18 to 20), regular, interrupted by a dorsal sulcus; the spaces between the ridges regularly concave; aperture wide, with parallel margins, somewhat produced and curved behind, terminating in a short, wide canal, and slightly notched in front; the outer lip, towards the middle, is curved correspondingly with the shape of the body-whorl, and presents a wide but not much raised border along the outer edge. The dorsal sulcus, which is very distinct, becomes wider and deeper at each extremity. The transverse ridges are more numerous on the right lip than across the back, as several short ones rise out of the aperture, which scarcely extend beyond the outer margin. In the young shell, (fig. 7*a*—*c*), the right lip is obscurely dentated towards the front, but is otherwise smooth; it presents a raised border along the outer edge.

*Size.*—Axis rather more than 4-10ths of an inch; diameter, 3-10ths of an inch.

*Localities.*—Highcliff, and Alum Bay: (Strat. No 29, Prestwick).

### No. 77. CYPRÆA WETHERELLII. *F. E. Edwards.* Tab. XVII, fig. 3*a*—*d*.

CYPRÆA PEDICULUS? *Webst.* (Observations on the strata over the Chalk, &c.,) Geol. Trans., 1st Ser., vol. ii, p. 204.

*C. testâ parvâ, sub-globosâ, transversim lineatâ; lineis tenuibus, numerosis; sulco dorsali vix conspicuo non interruptis; aperturâ sub-medianâ, leviter arcuatâ, posticè productâ, sub-canaliculatâ.*

Shell small, nearly globose, slightly attenuated in front, transversely ridged; ridges thin, angular, not interrupted by the obscure dorsal sulcus, few in number as they emerge from the aperture, but becoming numerous by the bifurcation of some, and by the appearance of new ridges between others; aperture nearly central, narrow? slightly curved, produced behind, forming a short wide canal; outer lip ?

The specimen of this Cypræa from which the description and figure are taken is imperfect; the outer lip and the front of the columella are both broken, and the shelly matter on part of the back is decomposed, exposing a cast in the pyrites with which the interior of the shell is filled; but the posterior extremity of the outer lip and the triangular elevation which formed the left wall of the posterior canal remain. The continuation of the transverse ridges across the back of the shell, uninterrupted by the dorsal sulcus, is plainly shown.

This Cypræa is one of the many additions to our Eocene Fauna for which we are indebted to the indefatigable zeal of Mr. Wetherell, with whose name I designate the species. The specimen from which the figures are taken, was found in one of the cuttings made at Whetstone, on the formation of the Great Northern Railway. Another, and apparently a younger, specimen was also obtained by Mr. Wetherell from the railway cutting at Primrose hill.

Among the fossil Cypræe found in the Paris basin, is one belonging to the present section, which Lamarck considered to be identical with the recent *Cyp. pediculus*, but which, M. Deshayes, in his 'Description des coquilles fossiles,' &c., has shown to be distinct, and has named *C. Lamarckii*. Mr. Webster (*loc. cit.*) has recorded a fossil cowry as occurring at Highgate, and at Stubbington, which he also refers to *C. pediculus*. I have not met with any Cypræa belonging to this section, either from Stubbington or Bracklesham Bay; but it is not improbable that the Highgate specimen mentioned by Mr. Webster belonged to the present species, which, however, is more globose than *C. Lamarckii*, with a wider aperture, and more numerous transverse lines.

*Size.*—Axis, rather more than 3-10ths of an inch; diameter, 3-10ths of an inch.

*Localities.*—Whetstone, near Barnet; Primrose-hill.

### No. 78. CYPRÆA PRESTWICHII. *F. E. Edwards.* Tab. XVII, fig. 2*a*—*c*.

*C. testá parvá, ovato-oblongá, ventricosá, anticè attenuatá, canaliculatá, vix emarginatá, transversim lineatá; lineis numerosis, tenuibus, irregularibus, sulco dorsali, sub-mediano, obscuro, interruptis; aperturá angustá, lineari; labro involuto.*

Shell small, ovately oblong, ventricose, attenuated towards the anterior extremity, with a short canal, slightly notched in front, and covered with transverse ridges, interrupted on the back by an obscure, nearly medial sulcus; ridges slender, sharp-edged, numerous (18 to 20), irregular; aperture linear, narrow; outer lip incurved.

This Cypræa is not so pyriform as *C. platystoma;* the apex is not so elevated, the transverse ridges are less regular and not so numerous, particularly over the outer lip; and the aperture is linear without any posterior curve. The more globose form, the elongated aperture, and the posterior canal of *C. Wetherelli*, distinguish it from that species.

I am indebted for this cowry to Mr. Prestwich, to whom I have dedicated it.

*Size.*—Axis, rather more than ¼ of an inch; diameter, 2-10ths of an inch.

*Locality.*—Basingstoke.

## Genus 21st. OVULA. *Bruguière.* 1792.

AMPHIPERAS, *Gronovius*, 1781.
LICIUM, *Humphrey*, 1797.
CYPHOMA, *Bolten*, 1798.
OVULA, *Lamarck; Cuvier; Ferrussac; Deshayes; G. B. Sowerby; &c.*
OVULUS, *Montf.*, 1810.
CALPURNUS, *Montf.*, 1810.
ULTIMUS, *Montf.*, 1810.

Scymnia, *Leach*, 1819.
Simnia, *Risso*, 1826.
Calpurna, *Fleming*, 1828.
Volva, *Fleming*, 1828.
Cypræella, *Swainson*, 1840.
Carinea, *Swainson*, 1840.
Sect. Volva, *Bolten*, 1798.
Radius, *Montf.*, 1810.
Radius, *Schum.*, 1817.
Birostra, *Swainson*, 1840.

*Gen. Char.*—Shell ovate, gibbous, more or less attenuated or produced, and emarginate at each extremity; smooth, convolute upon a nearly horizontal plane; spire concealed: aperture longitudinal, elongated, narrow behind, more expanded in front; outer lip generally inflected, thickened, denticulated; inner lip smooth.

The Ovulæ present great similarities to the Cyprææ, both in the organization of the animal and the construction of the shell. The principal distinctions between the animals appear to be in the condition of the muzzle, and in the mantle, the surface of which, in the true Ovulæ, is always smooth. The shells are distinguished by the absence of teeth on the left margin of the aperture, and by the prolongation of the two extremities; but, like the Cowries, they are, when fully formed, smooth and polished, owing to the enamel-like coating secreted by the extended margins of the mantle.

The genus was first separated by Gronovius, under the name *Amphiperas*, and was afterwards defined by Bruguière under the present name, by which it has been generally received. Several dismemberments have been proposed by Bolten, Fleming, Leach, Swainson, and others, on conchological distinctions only. In one of these, the genus *Volva* proposed by Bolten for the well-known oriental shell, called the "weaver's shuttle,"(*Ovula volva*),the animal, according to Mr.Adams,* presents certain peculiarities, consisting of a row of nipple-like tubercles along the edge of the mantle, and of a narrow foot folded longitudinally and adapted for crawling upon the round slender stems of the Gorgoniæ and other zoophytes on which the animal feeds, which modifications appear to confirm the separation; but the other proposed divisions are for the present received as sections only of the present genus until more accurate knowledge of the anatomy and habits of the animals is acquired.

The living *Ovulæ* are not very numerous. and are, for the most part, inhabitants of warm climates; they are found principally in the seas of China, Western America, and the West Indies; one species only is found on our own shores. The fossil *Ovulæ* are very few; seven species from the cretaceous formations, five of which were described as *Cypræœ*, are referred by D'Orbigny to this genus; two species, exclusive of *O.* (*Cypræa*) *tuberculosa*, before described, occur in the Eocene tertiaries of France, and three are found in the more recent formations.

* 'Zoology of the Voyage of H. M. S. *Samarang*,' p. 19.

### No. 79. Ovula? antiqua. *F. E. Edwards.* Tab. XVII, fig. 3*a*—*b*.

*O. testá elongato-ovali, sub-ventricosá, posticè sub-acuminatá, lævi : aperturá angustá, posticè elongatá, in canali brevi, mediocriter lato, exeunti, anticè effusá.*

Shell of a lengthened oval form, somewhat ventricose in the middle, slightly acuminated at the posterior extremity, smooth: aperture elongated, narrow behind; posterior canal short, moderately wide. The anterior extremity is broken; it appears to have been rather more obtuse than the posterior one. The last volution is smooth, but the surface of the preceding volution presents numerous transverse striæ, perspicuous towards the posterior extremity, and becoming obsolete as they approach the middle of the whorl; these striæ are very fine, so much so as to be barely perceptible by the naked eye.

The only specimen I have seen forms part of Mr. Wetherell's collection; it is too imperfect for a detailed description, or even for ascertaining satisfactorily the genus to which it belongs. It is apparently an immature shell just emerging from the first stage of growth before the outer lip has become thickened or involute, and when the absence of teeth on the columella is not conclusive of the genus. It may be the young shell of a Cypræa, resembling the *C. acuminata* of Melleville, and, therefore, I have referred it to the present genus with doubt, and have named it provisionally only.

*Size.*—Axis, ½ an inch; diameter, 2-10ths of an inch.

*Locality.*—Primrose Hill.

## Genus 22d. Marginella.* *Lamarck.*

Porcellana, Peribolus, *Adanson*, 1757.
Dactylus, *Humphrey*, 1797.
Marginella, *Lamarck*, 1801.
Marginellus, *Montfort*, 1810.
Persicula, *Schum.*, 1817.
Volvaria, (sp.,) *Lamarck*, 1822.
Marginella, Glabella, } *Swainson*, 1840.
Volutella, Gibberula, }
Phænospira, Cryptospira, *Hinds*, 1844.

*Gen. Char.*—Shell oval, oblong, smooth, enamelled; spire short, sometimes almost concealed: aperture elongate, narrow, truncate, sometimes broadly but not deeply notched in front; outer lip thickened externally, inner margin sometimes smooth, generally crenated; columella with distinct plaits, more or less numerous.

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* Etym., Diminutive of *Margo*, a rim or margin.

This genus was first separated by Adanson, and afterwards by Humphrey, for shells previously referred either to Voluta or Mitra. Subsequently Lamarck defined it more exactly under the present name, by which it is now known. The animal resembles that of *Cypræa* in all essential particulars, and like it, is furnished with lobes to the mantle, which can be extended over the shell so as to cover the spire, which thus acquires an enamel-like covering resembling that of the Cowries. The condition of the spire, th number and the arrangement of the columellar plaits, and the simple or crenated state of the outer lip, have been used as characters for the separation of the *Marginellæ* into various genera; but these divisions do not appear to be warranted by generic distinctions in the animals and consequently, have not been generally adopted, but have been regarded as sections merely of the present genus. Mr. G. Sowerby (*Gen. Shells*), has suggested that the *Marginellæ* may be classed under two natural sections; the first comprising the species in which the spire is distinct, the columella furnished with four folds at the base, and the outer lip characterised by a thick fold-like border along the outer margin; the other consisting of the species in which the spire is short, almost concealed, the columellar plaits more numerous, the anterior plaits being the larger, and the outer lip but slightly thickened. The first section corresponds with *Glabella* (Swain.) and *Phænospira* (Hinds); the latter represents *Persicula* (Schum.), *Volutella, Gibberula, Marginella* (Swain.), and *Cryptospira* (Hinds).

The recent *Marginellæ* are numerous; they chiefly inhabit the tropical and subtropical seas, where they are found in shallow waters; they appear to abound on the coasts of Africa, and some few small species, belonging to the second section, are found in the Mediterranean. In the fossil state they first appear during the tertiary epoch. In the French eocene beds, eleven species occur, of which seven have been described by Lamarck and Deshayes; and of these, several are found in England, Germany, and Belgium. Six species from the corresponding formations in Alabama (U.S.), have also been described by Conrad and Lea: and in the more recent deposits in Europe and the United States, twenty additional species have been found.

### *Section A.* Spire apparent.

### No. 80. MARGINELLA EBURNEA. *Lamarck.* Tab. XVIII, figs. 1 *a—c.*

MARGINELLA EBURNEA, *Lamk.* 1803. Ann. du Mus., vol. ii, p. 61, No. 1; and vol. vi, t. 44, fig. 9.
— — *Roissy.* 1804. Buff. Moll., vol. vi, p. 9, No. 4.
— — *Lamk.* 1822. Hist. nat., vol. vii, p. 359, No. 15.
— — *Brogn.* 1823. Sur les ter. tert., du Vicent., p. 64, No. 1.
— — *Defr.* 1823. Dict. des sci. nat., vol. xxix, p. 145.

MARGINELLA EBURNEA, *Desh.* 1830. En. Méth. (Vers), vol. ii, p. 413, No. 13.
— — *Bronn.* 1831. Ital. Tertiärgeb., p. 18, No. 53.
— — *Desh.* 1824-37. Descr. des coq. foss., &c., vol. ii, p. 707, t. 95, figs. 14—16, and 20—22.
— — *J. Sow.* 1850. Dixon's Geol., &c., of Suss., p. 107.
— — ? *Phil.* 1851. Palæontographica (Tert. Foss. Magd.), vol. i, p. 79, No. 174.
— — ? *Beyrich.* 1853. Die Conchyl. des Norddeutschen tert., vol. i, p. 52, t. 2, figs. 9 *a*, *b*.
Nec. — — *Grat.* 1838. Cat. Zool., &c., de la Gironde, p. 50, No. 478.
nec. — — *Grat.* 1845. Conch. foss., &c., de l'Adour, t. 1, (Tarrière, &c.,) figs. 38—40.
nec. — — *Sismon.* 1847. Syn. meth., &c., Pedemont. Foss., p. 42, No. 46.

*M. testâ parvâ, ovato-elongatâ: spirâ acuminatâ, ultimo anfractu breviori; anfractibus convexiusculis, ad suturam confluentibus; aperturâ angustâ; labro posticè sinuato, extus marginato, intus mutico; columellâ quadriplicatâ.*

Shell small, elongated, with an elevated pointed spire, rather shorter than the aperture, and formed of five or six narrow, slightly convex whorls, somewhat depressed round the sutural margin, the sutures concealed by the enamel; body-whorl conoidal; aperture elongated, narrow, obscurely notched in front; lips nearly parallel; outer lip with a wide and moderately deep sinus at the suture, thickened and presenting a raised border along the outside margin, smooth within; columella nearly straight, and furnished with four narrow, almost equal folds, the front two of which are more oblique than the others.

M. Deshayes, when he separated *M. hordeola,* suggested at the same time that it might be only a variety of the present species; Dr. Beyrich in fact maintains the identity, and that the only distinction is the difference of size. I do not concur in this opinion. Both species belong to a group, in several of which the characters depend, to a great extent, on the condition of the aperture and the general form of the shell; characters in some instances difficult to define, but which strike the eye forcibly, and from their constancy acquire specific importance. The general form of the shell in *M. hordeola* is not so broad as that of *M. eburnea,* owing to the whorls being less convex; the spire is more obtuse, and comparatively shorter; and the aperture is longer and narrower, particularly at the posterior extremity, and it is more contracted at the middle in consequence of the greater involution of the outer lip. Other species occur in the *calcaire grossier,* belonging to this group, and hitherto undescribed, but which, as I learn from M. Deshayes, will be described in the forthcoming supplement to his 'Description des coquilles fossiles,' &c. One of these (*M. contabulata*), appears to be intermediate in size between *M. eburnea* and *M. hordeola,* and, in fact, to present a close general resemblance to the former. It is unnecessary to enter upon any examination of the characters distinguishing this new species; but it is not improbable that Dr. Beyrich may have associated specimens of *M. contabulata* with the true *M. hordeola.*

It is always hazardous, without the assistance to be derived from actual specimens, to express an opinion on questions of identity; but the figure given by Dr. Beyrich does not convey to my mind an idea of *M. eburnea;* the spire seems to be shorter and thicker, the apex to be more obtuse; the aperture to be shorter, less wide in front, less narrow behind; the outer lip is represented without the posterior sinus, and the folds on the columella appear to be more oblique. The figure agrees much better with *M. contabulata,* to which species, if it had been published, the German shell would more probably have been referred.

The present species appears to be confined to the older tertiary formations; the shells from Dax, and the neighbourhood of Bourdeaux, referred to it by Grateloup, belong to a different species, which D'Orbigny has named *M. sub-eburnea;* as do those from Turin, described by Sismonda, and to which Michelotti has given the name, *M. Taurinensis.*

*Size,* of the specimen figured, which forms part of Mr. D'Urban's collection, is, axis, 3-10ths of an inch; diameter, half the length of the axis. The French specimens are frequently much larger.

*Localities.*—Bracklesham Bay, where it is very rare. *French:* Grignon, Parnes, Courtagnon, Ermenonville, Acy, le Tombray (fide D'Orb.). *Italian:* Ronca, Val Sangonini (fide Brogn.) *German:* Osterweddingen in Magdeburg? (fide Beyr.)

### No. 81. MARGINELLA BIFIDO-PLICATA. *Charlesworth.* Tab. XVIII, figs. 2 *a—g.*

*M. testâ minimâ, ovato-globosâ, ad basin vix emarginatâ; spirâ conicâ, brevi, apice subobtuso; anfractibus convexis: aperturâ angustâ, longitudine spiram paulo superanti; labro crassissimo, compresso, extùs marginato, intùs acuto, posticè profundè emarginato; columellâ quadriplicatâ, plicis tribus posticis bifidis, pene transversis; plicâ anteriori acutâ, obliquâ.*

Shell very small, roundedly ovate, with a short, conical spire and a bluntish apex: aperture narrow, a little longer than the spire, with the margins nearly parallel: outer lip much thickened, presenting a prominent border along the outer margin, a sharp edge inwards, and a deep sinus near the suture; columella with four folds, of which the anterior one is sharp and very oblique, and the remaining three thick, bifid, and nearly transverse.

This marginella approaches very closely to a species from the Paris Basin, not yet described, but to which M. Deshayes has given the name *M. columbellina,* and a comparison with a longer series of that species than I possess, may eventually establish the identity. It appears, however, to be a broader and more ventricose shell, having a shorter spire and a narrower aperture than *M. columbellina*, and the columellar plaits are more strongly bifid than in that species. The outer lip in the adult shell also is flattened in front, and its inner margin presents a sharp edge; whereas in the French species the outer lip is rounded and rather involute. I must state that in the young shell, the columellar plaits in *M. bifido-plicata* are thin and simple, and that the bifid character is assumed only at maturity.

The other species from the *calcaire grossier* (*M. contabulata*), to which I have before referred, appears to be a longer and narrower shell than the present one; the whorls are distinct, notwithstanding the enamel, and present an obscure channel running round the suture; the mouth is more effuse in front, the outer lip not so much thickened, the posterior sinus obscure, and the columellar plaits more oblique.

The present species is found in profusion in the Highcliff sands; and sparingly in the Barton Beds. Specimens are also found, rather plentifully, in the corresponding stratum (No. 29, of Mr. Prestwich), in Alum Bay, larger and more regular in form and with a somewhat longer spire than the type, but agreeing with it in all essential characters (figs. 2 *e*—*g*), and I consider the last, therefore, to be merely a local variety. It also occurs in the stratum No. 4, Prestwich, in Alum Bay, and at Bracklesham Bay. The specific name is taken from the bifid condition of the columellar plaits, a character found, however, in several other species belonging to this group, although not so strongly marked as in the present one; it was proposed by Mr. Charlesworth, in a lithographic print of the species forming part of a series of figures of shells from Highcliff and Barton, beautifully executed, under the direction of that gentleman, for distribution among the members of the "Natural History Society."

*Size.*—Type, Axis, somewhat less than 2-10ths of an inch; diameter, 1-10th of an inch.

### No. 82. MARGINELLA GRACILIS. *F. E. Edwards.* Tab. XVIII, figs. 4 *a*—*c*.

*M. testâ minimâ, tenui, subfusiformi, ad basin vix emarginatâ; spirâ elevatâ, conicâ, apice obtuso: anfractibus quinque, convexis: aperturâ elongato-ovali, in longitudine spiram superanti, postice obscurè canaliculatâ; labro incrassato, extus marginato; columellâ quadriplicatâ, plicis tribus posticis obliquis, bifidis.*

Shell very small, slender, tapering nearly equally towards each extremity; spire elevated, conical, with an obtuse apex; whorls five, convex, the last whorl scarcely notched at the base: aperture of a lengthened oval shape, moderately wide, and rather longer than the spire; outer lip thickened within, and presenting a narrow, slightly raised border along the outer margin, and a small obscure channel at the suture; columella with four folds, of which the posterior three are bifid, and rather oblique.

This may be merely a variety or an immature state of *M. bifido-plicata*, and, as I have only two specimens before me, I have separated it with much hesitation. The shell is, however, narrower and slenderer, somewhat resembling *M. hordeola* in shape, but more regularly fusiform. One of the specimens has the outer lip thickened and margined, and it appears therefore, to have attained maturity; but the posterior sinus characteristic of this group and which is so strongly marked in *M. bifido-plicata*, is wanting, and is represented by an obscure, scarcely perceptible channel at the suture. The lip itself is not involute as in *M. hordeola*, but is simply thickened, and the front is round, not flattened, as in *M. bifido-plicata*.

The specimen figured is from Mr. D'Urban's cabinet.

*Size*.—Axis, 2-10ths of an inch; diameter, rather less than 1-10th of an inch.

*Locality*.—Barton, where it is scarce.

*Marginella dentifera*. (Lamarck.) This species is recorded in the list of "The Fossils of Bracklesham and Selsey," published in Mr. Dixon's '*Geology, &c., of Sussex*,' p. 107, on the authority of a specimen which formed part of my collection, but which, unfortunately, has been broken: I am not aware that any other individual has been found. The species is very rare in France; and as Mr. Sowerby, by whom the list was prepared, did not himself see the specimen, the identification cannot be relied on; I have therefore not included *M. dentifera* among the English eocene Marginellæ.

### *Section B*. Spire concealed or nearly so.

### No. 83. MARGINELLA OVULATA. *Lamarck*. Tab. XVIII, figs. 5 *a*—*c*.

MARGINELLA OVULATA, *Lamk*. 1803. Ann. du Mus., vol. ii, p. 61; vol. vi, t. 44, fig. 10.
— — *Roissy*. 1804. Buff. Moll., vol. vi, p. 10, No. 6.
— — *Lamk*. 1822. Hist. nat., vol. vii, p. 359, No 17.
— — *Defr*. 1823. Dict. des sci. nat., vol. xxix, p. 145.
— — *Desh*. 1824-37. Desc. des coq. foss., &c., vol. ii, p. 707, t. 94 bis, figs. 27—29.
— — *Desh*. 1830. Enc. méth. (Vers), vol. ii, p. 416, No. 20.
— — *Bronn*. 1831. Ital. Tertiärgeb., p. 18, No. 52.
— — *Bronn*. 1838. Leth. geog., p. 1106, t. 42, fig. 44.
— — *J. Sow*. 1850. Dixon's Geol., &c., of Sussex, p. 107, t. 7, fig. 38.
— — ? *Beyrich*. 1853. Die Conchylien des Norddeutschen tert., vol. i, p. 49, t. 2, fig. 10*a*—*b*.
MILIACEA ? *Philippi*. 1851. Palæontographica (Tert. foss. Magd.), vol. i, p. 79, No. 177.
Nec. — OVULATA, *Grat*. 1838. Cat. Zool., &c.. de la Gironde, p. 50, No 481.
nec. — — *Grat*. 1845. Conchy. foss., &c., de l'Adour, t. 1, fig. 35.
nec. — — *Sism*. 1847. Syn. meth., &c., Pedemont. foss., p. 46.

*M. testâ ovato-oblongâ, ad basin late emarginatâ; spirâ brevissimâ: aperturâ elongato-*

*angustâ; labro sub-marginato, intùs crenulato, posticè dilatato; columellâ rectâ, quinquies plicatâ.*

Shell oblong, ovate, with a very short obtuse spire, formed of but few whorls, the sutures of which are barely separated from each other; the body-whorl, which of itself forms almost the entire shell, is widely but not deeply notched in front. The mouth is long, narrow, and curved at the posterior extremity; the columella straight and, generally, furnished with five folds, occasionally with six or even more; the anterior folds are larger and more oblique than the others, which decrease in size as they ascend the columella. The outer lip is curved, expanding near the suture into a rounded wing-shaped projection; it is finely crenulated within, slightly thickened, and presents a narrow raised border running along the outer margin.

Some confusion appears to exist between the present species and a living species common in the Mediterranean (*M. miliacea*), placed by Lamarck in his genus *Volvaria.* This latter species is mentioned by Dujardin as occurring in the miocene formation in the neighbourhood of Tours; and Philippi and Sismonda have also recorded it as found in the upper miocene of Piedmont. Dujardin's shell, however, appears to be distinct, and the identification of the last is very questionable. The same species is also cited by Grateloup, although with a query, as identical with the present species, to which he has referred some shells from the miocene beds of Bourdeaux and Dax; but which, as well as certain shells from the synchronous beds of Turin, described by Michelotti as *M. ovulata*, belong to a different species to which D'Orbigny has given the name *M. sub-ovulata.* On the other hand, a Marginella from the miocene beds near Vienna, formerly considered to belong to the present species, has been regarded by Hörnes as identical with *M. miliacea*, and Philippi has also recorded a shell from Westeregeln, as belonging to the recent species. Dr. Beyrich, however, has pointed out with much precision, the specific differences between the *M. miliacea* and *M. ovulata*, and he seems to think that the shells mentioned by Hörnes and by Philippi, belong in fact, to the present species, which, apparently, is confined to the older tertiary formations; while, as yet, there is no ground for considering that *M. miliacea* occurs in any formation older than the upper miocene, if it occur even in that.

Whether or not the German shells are referable to the present species, is a doubtful question. The figure given by Dr. Beyrich does not agree with the French shells; the spire is more produced; the aperture, consequently, is proportionally shorter, and it is wider in front; the outer lip, apparently, is without the wing-shaped projection so characteristic of the true *M. ovulata;* and the folds on the columella are more distant and more oblique. Bronn's shell, so far as an opinion can be formed from the somewhat coarse and indistinct figure given by him, appears to agree much better.

The specimen figured is, I believe, unique, and although not in a very good state of preservation, is sufficiently so for determining the identity.

*Size.*—The French specimens of this species vary considerably in size, some exceeding half an inch in length; while others, in a state of maturity, barely attain half that size. The figured specimen is nearly 4-10ths of an inch long, by ¼ of an inch wide.

*Localities.*—Bracklesham, where it is very rare. *French:* Grignon, Parnes, Mouchy, Courtagnon, Creil, Vexin, Acy (fide D'Orb.). *Italian:* Castel-Gomberto, near Vicenza (fide Bronn), Magdeburgh (fide Phil.), Westeregeln? (fide Beyr.), Gainfahren? (fide Hörnes).

### No. 84. Marginella pusilla. *F. E. Edwards.* Tab. XVIII, figs. 6 *a—c.*

*M. testâ minimâ, ovali; spirâ exsertiusculâ, apice obtuso: aperturâ elongatâ, mediocri, anticè profundè emarginatâ; labro extûs marginato, intûs crenulato; columellâ sub-rectâ, quinquies vel sexies plicatâ, plicis fere transversis, sub-æqualibus.*

Shell minute, oval; spire slightly elevated, with an obtuse apex: aperture elongated, moderately wide and deeply notched in front; outer lip thickened along the outer margin, and finely crenulated within; columella nearly straight, with five or six folds, of which the anterior two are the longer and slightly oblique, and the others are almost transverse and nearly equal in size.

This pretty little Marginella appears to be perfectly distinct from all its congeners. It occurs rather plentifully in the Highcliff sands; but apparently disappears in the Barton sands and clay, as I have not met with any specimen from those deposits. It reappears in the fluvio-marine formation in Headon Hill, in which it is found sparingly.

*Size.*—Axis, not quite 2-10ths of an inch; diameter, 1-10th of an inch.

### No. 85. Marginella simplex. *F. E. Edwards.* Tab. XVIII, figs. 8 *a—c.*

*M. testâ ovato-oblongâ; spirâ brevissimâ, pænè obtectâ; aperturâ elongatâ, posticè angustâ, antice latiori, ad basin latè emarginatâ; labro extûs incrassato, intus mutico; columellâ quinquies vel pluries plicatâ.*

Shell small, ovate-oblong; spire short, depressed, almost concealed; aperture elongated, narrow behind, effuse, and widely but not deeply notched in front; outer lip thickened along the margin, smooth, uncrenulated within; columella with two distant slightly oblique folds in front, and three or more obscure, nearly transverse, folds behind.

This species so closely resembles *M. ovulata* in its general aspect, that a hasty comparison would lead to the two being regarded as identical: there are, however, several differences which entitle the present shell to specific distinction. The spire is shorter and more depressed, and the anterior folds on the columella are more distant, and not so oblique; but that which particularly distinguishes *M. simplex* is the condition of the outer lip, which is smooth within, nearly straight, and without the posterior dilatation which characterises *M. ovulata.*

*Locality.*—Estuary bed at Mead-end, near Hordwell.

*Size.*—Axis, rather more than 3-10ths of an inch; diameter, 2-10ths of an inch.

### No. 86. MARGINELLA VITTATA. *F. E. Edwards.* Tab. XVIII, figs. 7 *a—c.*

*M. testâ ovulatâ; spirâ brevissimâ, depressâ: aperturâ elongatâ, mediocri, antice effusâ, profundè emarginatâ; labro incrassato, intùs obsoletè crenulato; columellâ quadriplicatâ, plicis anterioribus fere æqualibus.*

Shell ovate-oblong, with a very short, depressed, almost hidden spire: aperture long, moderately wide, curved at the posterior extremity, effuse in front, and deeply notched at the base; outer lip thickened along the outer margin, feebly crenulated within; columella with three thickish, nearly equal folds in front, and an obscure one behind.

Although nearly resembling *M. ovularis* (Lamk.), this present species is easily distinguished from that by the general shape, which is shorter and broader, by the depressed spire, by the aperture, which is wider and without the contraction at the middle characteristic of the French species, and by the folds, which are not so numerous, and not quite so oblique. The narrower aperture, the smooth uncrenulate outer lip, the more numerous folds, and the greater size of *M. simplex,* separate that species from the present one.

One of the specimens exhibits faint traces of several transverse bands, from which circumstance the specific name is taken; these bands are of a dark brown colour.

*Locality.*—Headon Hill.

*Size.*—Axis, 3-10ths of an inch; diameter, rather more than half the length of the axis.

## *Family*—VOLUTIDÆ.

### Genus 23d. VOLUTA. *Linn.* 1767.

VOLUTA, *Scopoli,* 1777.
— *Bruguière,* 1792.
— *Lamarck,* 1801.
— *Montfort,* 1810.
MUSICA, *Humphreys,* 1797.
PLEJONA, *Bolten,* 1798.
FULGURARIA, *Schum.,* 1817.
SCAPHELLA—HARPULA—VOLUTILITHES, *Swainson,* 1840.

*Gen. Char.*—Shell sub-ovate or elongately fusiform, more or less ventricose; volutions smooth, longitudinally ribbed, transversely sulcated or cancellated; spire short, apex pointed, or more or less mammellated; aperture longitudinal, large, notched at the base; outer lip thin and sharp-edged in the young state, sometimes thickened and plicated within at maturity; columellar plaits more or less numerous, oblique, the anterior plaits the largest.

The genus Voluta, as characterised by Linnæus, comprised the various shells in which the columellæ were plaited; and it represented, in fact, as a French author* has remarked, that group of genera which constituted Lamarck's family of *columellata.* After numerous dismemberments, the genus was defined first by Bruguière, and subsequently by Lamarck; but, even as thus restricted, a more extended knowledge of the animals has led to a still further curtailment of it by the withdrawal of the genera *Cymba* (Brod.) and *Melo* (Brod.)

The animal is of an oval form, with a large broad foot, extending beyond the shell on every side; the head is large, terminating in a short thick muzzle, and bearing short triangulated tentacles, at the outer bases of which the eyes are seated. The mantle, which is sometimes extended so as to cover the sides of the shell, is furnished with two lobes in front, between which it is produced into a short siphon, bent backwards towards the shell.

The recent Volutes are numerous, and many of them are of considerable size, and distinguished by the beauty of their colouring; they are, for the most part, inhabitants of equatorial seas, frequenting sandy bottoms. In the fossil state they are equally numerous; they first appear in the earlier cretaceous deposits, and nearly twenty species from the several formations of that epoch at Pondicherry, and in different parts of Europe, have been described by Professor E. Forbes and by Dr. Mantell, Matheron, D'Orbigny, and others. More than twice that number have been described by MM. Lamarck, Deshayes, J. Sowerby, Nyst, Philippi, and other authors, from the Eocene formations in Europe, and by Conrad and Lea from those of Maryland and Alabama, in the United States; while upwards of twenty species have also been described from the more recent formations.

On a comparison between the recent Volutes and their Eocene congeners, the prevailing characters of the two groups may be stated, in general terms, to be that, in the recent shells, the apex of the spire is broadly mammellated, the volutions are smooth or longitudinally costated, and the columellar folds thick and prominent; while, in the fossil shells, the apex is generally pointed, the volutions for the most part are transversely striated, sometimes cancellated, and the columellar folds are indistinct or comparatively feeble. These distinctions induced Mr. Swainson to separate the fossil species under the generic name Volutilithes, taking *Vol. spinosa* (Lam.) as the type. A cursory examination of the two groups, however, will suggest, I think, that a generic separation is unnecessary. The mammellated apex, which is formed by the large development of the shell in embryo, cannot be regarded as a character of generic value; in fact, we find, among the recent Volutes, on the one hand, every degree of development between the broadly mammellated apex of *Vol. imperialis* and the pointed, almost mucronate, spire of *Vol. Harpa;* and among the fossil Volutes, on the other hand, we may trace the apex gradually enlarging from the small conical pullus of *V. luctatrix* and *V. spinosa* through *V. cithara, V. muricina,* &c., into the papillary pullus of *V. Wetherelli,* and thence into the mammellated apex of the Crag species, *V. Lamberti.* Similar variations may be observed in the condition of the columellar plaits. The characters in question, therefore, cannot, I think, be regarded as of generic value, however useful they may be for the division of the genus into groups.

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* C. d'Orbigny's 'Dictionnaire Universel d'Histoire Naturelle.' Art., *Volute.*

Since the genus *Volutilithes* was proposed, the recent species *V. abyssicola* has been discovered. This Volute, which was dredged off the Cape of Good Hope at the great depth of 132 fathoms, presents a very close resemblance to some of the Eocene species, and appears to be the sole living representative of the group.

By far the greater part of the numerous eocene species which belong to this genus, are ribbed, or crowned with spines, and transversely furrowed; and the specific characters are taken chiefly from the varied conditions or the absence of these ornaments, and also from the condition of the outer lip, and the columellar folds. With regard to the specific distinctions which depend on the condition of the ribs and spines, or on the transverse sulcation, it must be borne in mind that these characters are subject to considerable modification by age; and that in almost all the species, the shells, even those which are simple and smooth at maturity, are, in their very early state, ribbed and coronated, as well as transversely sulcated. In some species, these ornaments disappear after the first three or four whorls; in others they become gradually more or less obliterated as the shells are enlarged; and the ribs in the young shells are, almost invariably, more numerous, and extend further over the whorl than in mature specimens. The character of the spines is subject to considerable modification, and the number of the columellar folds is also liable to slight variation in the same species. These characters, therefore, must be used with caution, and with a due regard to the apparent age of the specimens. The characters which appear to be the most certain are those which depend on the condition of the pullus or embryonic shell, on that of the notch at the base of the shell, and on the more or less effuse state of the inner lip. The condition of the notch, in case the notch itself is not preserved, will be found represented by the ridge at the base of the columella, called the "comb" or "crest," which is due to the reflexion of the base of the shell caused by the notch, and will be more or less prominent, according to the greater or less depth of the notch.

The following distribution of the English species into groups is made solely with a view to assist the student in the frequently perplexing task of arrangement; and it is not proposed as possessing any value, except in so far as it may contribute towards the attainment of that end.

*Section A.* *Pullus small, conical.*

*a. Shell turbinate or pyriform; costated or coronated; inner lip effuse; columellar plaits few.*

*a. Transversely furrowed.*

No. 87. VOLUTA LUCTATRIX. *Solander.* Tab. XVIII, fig. 3. Tab. XIX, fig. 3 *a—e.*

LIMINGTON THORNEY-RIBS, *Petiver,* 1764. Gazophylacium, t. 78, fig. 11.
STROMBUS LUCTATOR, *Solander,* 1766. Brand. Foss. Hant., p. 30, figs. 64 and 67.
— DUBIUS — — — fig. 68.
VOLUTA MUSICALIS, *Webster,* 1814. Geol. Trans., 1st ser., vol. ii, p. 204.
— LUCTATOR, *Sowerby,* 1816. Min. Con., vol. ii, p. 29, t. 115, fig. 1.
— — — 1823. — vol. iv, p. 134, t. 397.

*V. testá elongato-turbinatá, costatá, transversim sulcatá, antice late emarginatá; apice acuto: anfractibus superne concavis, angulatis, uná serie spinarum, costas coronantium, donatis; spinis brevibus, cuspidatis: aperturá in medio effusá, antice angustatá; columellá duas plicas obliquas proeminentes gerenti; labro ad marginem crenulato, intus lævi, in juventá sæpe plicifero, incrassato.*

Shell elongately top-shaped, contracted in front, longitudinally ribbed, transversely furrowed; whorls angular at the shoulder, concave between the angle and the suture, and widely, but not deeply, notched in front; ribs sharp, curved, extending over nearly two thirds of the whorls, and crowned by a single row of erect, laterally compressed spines. In young shells the ribs are numerous, and a second row of small, irregular spines runs round the sutural margin; but the ribs become more distant, and the second row of spines disappears as the shell approaches maturity. The furrows are numerous, regular, rather broad and flat, and roughened by the prominent lines of growth. Spire elevated and pointed, the embryonic shell consisting of two or three very small, roundish, whorls; aperture angular behind, effuse at the middle; columella round, nearly straight, furnished with two unequal, oblique, prominent folds towards the front, the anterior one of which is the larger, and generally with two or three smaller ones behind. The outer lip in the young shell thickened and frequently plicated within; the plaits, however, when they do occur, disappear as the shell is enlarged, and in adult specimens the inner surface of the lip is smooth; in all stages of growth the outer lip is crenulated on the margin. Not infrequently, specimens occur in which the pearly matter, deposited by the margin of the mantle, remains; it is spread over the front of the body whorl, extending backwards almost to the suture.

Lamarck has cited *Strombus luctator* (Brand., fig. 64) as identical with his *V. musicalis;*

the latter, however, is a shorter, thicker, and coarser shell, with a proportionally longer spire; the columellar folds are four, more transverse, and nearly equally prominent; the outer lip, in all stages of growth, is without plaits, and the inner lip, which is but little spread out, does not extend backwards beyond the suture. Brander's shell (fig. 65) does not belong to this species; and Lamarck, in fact, referred it to his *V. spinosa*, which is, however, a much less ventricose shell. It belongs to Mr. Sowerby's *V. spinosa*, var. β.; the latter is, as that gentleman suggested, a distinct species, and I have separated it under the name *V. Solandri.* Brander's *Strom. dubius* (fig. 68) is without doubt a young individual of the present species.

*Size.*—Axis, 5 inches nearly; diameter 2½ inches nearly.

*Localities.*—Barton Cliff and the corresponding formation in Alum Bay (Stratum No. 29, Prestwich.) Bracklesham Bay?

### No. 88. VOLUTA NODOSA. *Sowerby.* Tab. XIX, figs. 1 *a—h.*

VOLUTA NODOSA, *Sow.* 1818. Min. Con., vol. iv, p. 135; t. 399, fig. 2; vol. 7, p. 6; t. 613, fig. 1.
— — *Defr.* 1829. Dict. des Sci. nat., vol. lviii, p. 481.
— — *Sow.* 1850. Dixon's Geol. &c., of Suss., p. 103; t. 5, fig. 23.
— DEVEXA? *Beyr.* 1853. Die Conchyl. des Norddeut. tertiär., vol. 1, p. 61; t. 3, figs. 6 *a*, *b*, 7 *a*, *b*.

*V. testâ ovato-acutâ, obscure costatâ, transversim sulcatâ; spirâ elevatâ, sub-conicâ, apice acuto: anfractibus obtuse angulatis, binâ serie spinarum nodiformium coronatis; aperturâ angustâ, in medio latiori; labro ad marginem crenulato, intus plicato; labio late expanso; columellâ triplicatâ.*

Shell ovate, pointed, obscurely ribbed, transversely furrowed; spire elevated, almost conical, with a small pointed apex; whorls, five or six, slightly convex, obtusely angulated at the shoulders; the ribs, which in the fully-grown shell are obscure and scarcely extend to the middle of the whorl, terminate at the shoulder in a row of blunt, nodiform spines; a second row of blunt spines, corresponding with the first, runs round the sutural margin, but becomes almost obsolete on the last whorl. The space between the suture and the shoulder is moderately wide, slightly concave, obscurely sulcated; the furrows on the whorls are narrow, concave, and separated by wide flat spaces, roughened by sharp conspicuous lines of growth. The aperture is rather narrow at each extremity, wider in the middle; the outer lip bluntly angulated towards the posterior extremity, crenulated on the margin, and plicated within; the inner lip is spread over the front of the body-whorl, extending backwards to the spines on the preceding whorl, and much thickened; the columella is a little flattened, and furnished with three folds, the anterior one of which is distant from the others, and large and prominent.

The present species, founded on a specimen from Barton Cliff, is widely spread, and ranges downwards to our older Eocene formations; since the Volutes which occur so abundantly in the neighbourhood of London, as well as some from Bracklesham Bay, although they present points of difference, yet, on the whole, agree so closely with the type that they cannot be regarded otherwise than as local varieties. In the Highgate shells (figs. 1 *c, d,*) the second row of spines disappears more early than in the Hampshire specimens, and the sutura margin is much thickened; the columella and the folds upon it, in the younger specimens, resemble those of the type, but, in the mature shell, the columella is more flattened, and additional folds arise among the normal ones, which latter become thicker and more prominent, the whole assuming a callus-like appearance; the outer lip also is thickened, and the principal spines are not so nodiform. The identity of the Bracklesham Bay shells (figs. 1 *e, h,*) with the present species is not so obvious; in them the whorls are wider and more sharply angulated on the shoulder, the ribs are generally more distant, and the spines acute and larger; but among the Highgate shells individuals occur in which the whorls are more sharply angulated, and the spines sharp and projecting. In the thickened sutural margin, the thick, plicated outer lip, the condition of the columella, and the character of the columellar folds, the Bracklesham Bay shells agree with those from Highgate, and I am unwilling, therefore, to consider them to be distinct from the present species.

Dr. Beyrich (*loc. cit.*) has described a Volute from Westeregeln, in Magdeburg, which he has named *V. devexa,* and which he considers to be identical "with a species from Barton not described by Mr. Sowerby;" and, he adds, that "most certainly" his species cannot be the young condition of "*V. nodosa,* for which the species in question from Barton seems to have been considered." Dr. Beyrich refers to the Highgate Volute, figured in vol. 7, Min. Con. (t. 613, fig. 1), which, he says, "in fact resembles the *V. devexa* of Barton;" and also to the Bracklesham Bay Volute figured in Mr. Dixon's work; and this last, he adds, "judging from the figure, is scarcely distinguishable from the Barton species." One of the prominent characters of the Hampshire shells is the very obtuse angle at which the whorl is bent at the shoulder, giving a subconical form to the spire. This character distinguishes the Highgate shells, although, as I have stated, it is less strongly marked in those from Bracklesham Bay; it is also found in the Westeregeln shells, and is particularly noticed by Dr. Beyrich; but I know of only one other Volute from the Hampshire beds which possesses it (*V. ambigua, Sol.*), and this species, even in the costated variety, is perfectly distinct. I am at a loss, therefore, to conceive what the Barton shell is to which Dr. Beyrich refers. His *V. devexa* agrees so closely with the Highgate form, both in description and figure, that considering, as I do, the Highgate shell to be merely a local variety of the Hampshire *V. nodosa,* I should have cited *V. devexa* as identical without hesitation, had not that gentleman expressly stated that it could not be referred to the present species.

*Size.*—Axis, 2 inches; diameter, 1 inch.

*Localities.*—Barton, Bracklesham Bay, Highgate, Sheppey. *German,* Westeregeln in Magdeburg? (fide Beyr.)

### No. 89. Voluta ambigua. *Solander.* Tab. XIX, figs. 4, *a—c*.

Strombus ambiguus, *Soland.* 1766. Brand. Foss. Hant., p. 32; t. 5, fig. 69.
Voluta bicorona, *Webster.* 1814. Geol. Tran., 1st Ser., vol. ii, p. 204.
— ambigua, *Sowerby.* 1823. Min. Con., vol. iv, p. 135; t. 399, fig. 1.
Nec — — *Lamk.* 1811. Ann. du Mus., vol. xvii, p. 78, No. 12.
nec — — *Ib.* 1822. Hist. natur., &c., vol. x, p. 352, No. 12.
nec — — *Desh.* 1824-37. Desc. des coq. foss., vol. ii, p. 691; t. 93, figs. 10, 11.
nec — — (Var. *Monstrosa*) *Sow.* 1816. Min. Con., vol. ii, p. 31; t. 115, fig. 5.
nec — — *Mant.* 1822. Foss. of the S. Downs, p. 108; t. 18, fig. 8.
nec — — *Grat.* 1845. Conchyl. foss., &c., de l'Adour, t. 1, figs. 14, 15.
nec — — *Rouault.* 1850. Desc. des foss., &c., de Pau. (Mém. de la Soc. Géol. de France, 2d ser., vol. iii, p. 457; t. 18, figs. 15, 16.)
nec — — *D'Arch.* 1850. Desc. des foss. du groupe Nummul. (Mém. de la Soc. Géol. de France, 2d ser., vol. iii, p. 447.)

*V. testá ovato-oblongá, costellatá, transversim sulcatá, ad basin emarginatá; spirá conicá, elevatá, apice acuto: anfractibus convexis, per-obtuse angulatis; costellis numerosis, irregularibus, tuberculis per-minutis, acutis, terminantibus: aperturá postice sub-canaliculatá, angustatá, in medio effusá; labro intus incrassato, plicato, ad marginem crenulato; columellá sub-rectá, rotundatá, bis vel ter plicatá.*

*Var.* COMPRESSA *testá costatá; anfractibus angulatis; costis pro-eminentibus, sub-distantibus, compressis, tuberculis nodiformibus coronatis.*

Shell ovately oblong, longitudinally ribbed, transversely furrowed, widely, not deeply notched in front; spire conical, elevated, pointed; whorls convex, scarcely angulated at the shoulder; ribs numerous, irregular, slender, extending nearly to the base of the shell, and terminating above in a single row of very small spines or pointed tubercles; in the young state a second row of imperfect spines runs round the whorl near the suture, but disappears as the shell is matured. The space between the suture and the row of tubercles is nearly flat, and presents a slender, but prominent, raised line running along the middle, and sometimes an additional faint one on each side of the centre line. The furrows are rather numerous, irregular, and traversed by very fine, but conspicuous, lines of growth. The aperture is contracted at the posterior extremity, effuse at the middle; the outer lip much thickened, plicated within, and crenulated on the edge; the columella round, straight, and furnished with two nearly equal prominent oblique folds in front, and sometimes one or two obscure ones behind.

The rounded shoulders, convex whorls, and conical spire, impart to this Volute a regularity of form which distinguishes it from all its congeners. The margins of the mantle of the animal appear to have been capable of considerable extension, for the porcellanous matter deposited is occasionally found widely spread, covering the whole of the under surface of the body-whorl, and reaching almost to the very apex of the spire.

A Volute from the lower *calcaire grossier* has been referred by Lamarck, and subsequently by Deshayes, to Brander's *Strom. ambiguus;* the French shell, however, is quite distinct, not only as to the spire, which, owing to the flattened sutural margin of the whorls, has a turreted aspect, but also as to the condition of the spines, the columella, and the columellar folds. Lamarck's shell is, in fact, the *V. elevata* of Sowerby. Deshayes has also cited Brander's fig. 70 for his *V. ambigua;* that shell is, however, equally distinct; it is the *V. suspensa* of Sowerby. Lamarck's *V. bicorona,* for which that author, as well as Deshayes, has cited Brander's fig. 69, is distinguished from this species by the double row of tooth-like spines which crowns the whorls, by the shorter and less conical spire, and by the smooth outer lip.

Specimens frequently occur in the sands of Barton, in which the ribs are less numerous, more prominent, and laterally compressed; the tubercles assume the form of erect, blunt spines: the outer lip is thin and crenulated, and, in many instances, smooth within, although in others a comparatively feeble internal plication is found. These specimens present a close resemblance to immature shells of *V. luctatrix,* and, on a cursory examination, might be referred to that species. The largest of the many I have seen, barely exceeds in size the individual figured (fig. 4, *c*), and, in all instances, the conical form of the spire and the obtusely angulated condition of the whorls which characterise the present species are found. I am induced, therefore, to regard these shells as forming a variety of *V. ambigua* rather than of *V. luctatrix.*

The Volute from the chalk formations of Sussex, described by Dr. Mantell, does not belong to the present species to which that author referred it, and D'Orbigny ('Prod. de Pal.,' vol. ii, p. 154, No. 171) has named it *Pseudo-ambigua.* Grateloup's shells, from Dax, Gaas, and Lesbarritz, belong to Lamarck's *V. ambigua,* to which species they are referred.

*Size.*—Axis, rather more than 2 inches; diameter, 9-10ths of an inch.

*Localities.*—Barton; Alum Bay (Stratum No. 29, Prestwich).

### No. 90. Voluta digitalina. *Lamarck.* Var. Lima. *Sowerby.* Tab. XIX, figs. 2 *a—c.*

Buccinum scabriculum, *Sol.* 1766. Brand. Foss. Hant., p. 33; t. 5, fig. 71.
Voluta digitalina, *Lamk.* 1811. Ann. du Mus., vol. 17, p. 77, No. 10.
— — *Ib.* 1822. Hist. Nat., vol. vii, p. 351, No. 10.
— lima, *J. Sow.* 1823. Min. Con., vol. iv, p. 136; t. 398, fig. 2.
— digitalina, *Defr.* 1829. Dict. des Sci. nat., vol. lviii, p. 477.
— — *Desh.* 1824-37. Desc. des coq. foss., vol. ii, p. 693; t. 93, figs. 1, 2.
— lima, *Morris.* 1843. Cat. Brit. Foss., p. 168.
— scabricula, *D'Orb.* 1850. Prod. de Pal., vol. ii, p. 415, No. 1468.
— crenulata. *Sow.* 1850. Dixon's Geol., &c., of Sussex, t. 5, fig. 22.

*V. testá ovato-oblongá, costatá, transversim sulcatá, antice sub-profunde emarginatá; spirá brevi, acuminatá: anfractibus convexiusculis, uná serie spinarum dentiformium coronatis, ad margines suturales planatis; costis numerosis, angustis, acuti-nodosis, ad basin tendentibus: aperturá elongato-angustá; labro intus incrassato, plicato, ad marginem crenulato; columellá triplicatá.*

Shell oblong-oval, ribbed, transversely sulcated, rather deeply notched at the base; spire short, pointed; the ribs narrow, rather numerous, extending to the very base of the whorl: whorls rather convex, crowned by a single row of short, erect, sharp tooth-like spines, between which and the suture the margin is flattened, forming a narrow channel or ledge, which runs round the spire and gives a turreted aspect to the shell. The furrows are separated by a narrow line, which rises into small pointed knobs, where it crosses the ribs, and are roughened by numerous sharp, perspicuous lines of growth; the last furrow, immediately in front of the spines, is wider than the rest. The aperture is long and narrow; the outer lip thickened, plicated within, and crenulated on the margin; the inner lip is not much spread over the body whorl, and does not extend backwards beyond the suture.

In the French shells the ribs are close and broader; the elevated parts, where they are crossed by the furrows, are consequently blunter and more nodiform than in the English shells; the ribs also, instead of being crowned with erect pointed spines, terminate in thick round knobs, which extend partly over the margin towards the suture, and the outer lip, although thickened, appears to be not plicated within. Dr. Beyrich considers *V. lima* to be a different species to *V. digitalina;* but in all respects, except those pointed out, the two agree so well that, notwithstanding this high authority to the contrary, I regard the French shell as a local variety only of Brander's *Bucc. scabriculum.*

The shell from Bracklesham Bay, figured in Mr. Dixon's work (t. 5, fig. 22) as *V. crenulata,* belongs in fact to this species. Defrance, indeed, suggests that *V. scabricula* may probably be only a variety of *V. crenulata,* modified by local conditions. It is difficult to ascertain to what extent specific characters may be modified by external conditions; but the different sculpture, the narrower aperture, the deeper notch, the less effuse inner lip, and the thickened plicated outer lip of the shells under description, appear to me to justify their being retained as a distinct species.

*Size.*—Axis, 1 inch and 4-10ths nearly; diameter, 6-10ths of an inch nearly.

*Localities.*—Barton, Alum Bay (Stratum No. 29, Prestwich), Highcliff, Bracklesham Bay. *French*: Valmondois, Betz, Monneville, Tancrou (fide Desh.).

### No. 91. Voluta elevata. *Sowerby.* Tab. XX., figs. 2. *a—d.*

Voluta ambigua, *Lamk.* 1811. Ann. du Mus., vol. xvii, p. 77, No. 12.
— — *Ib.* 1822. Hist. nat. &c., vol. vii, p. 352, No. 12.
— — *Desh.* 1824-37. Descr. des coq. foss., vol. ii, p. 691; t. 93, figs. 10, 11.
— elevata, *Sow.* 1840. Min. Conch., vol. vii, p. 7; t. 613, fig. 4.
— ambigua, *Gratel.* 1845. Conch. foss. &c., du bassin de l'Adour, Supp. Volutes, t. i, figs. 14, 15.
— — *D'Arch.* 1850. Desc. des foss. du groupe Numm. (Mem. de la Soc. Géol. de France, 2d ser., vol. iii, p. 447).
— — ? *Rouault.* 1850. Desc. des foss. &c. des environs de Pau (Idem, 2d ser., vol. iii, p. 457).
— sub-ambigua, *D'Orb.* 1850. Prod. de Paléont., vol. iii, p. 10, No. 150.

*V. testâ oblongo-ovatâ, sub-turritâ, transversim sulcatâ, longitudinaliter costatâ; spirâ elevatâ, acutâ: anfractibus convexiusculis, ad margines suturales planatis; sulcis posticis latioribus; costis fere ad basin tendentibus, duas vel tres series spinarum dentiformium inter sulcos posticos gerentibus: labro ad marginem crenulato; labio parum expanso; columellâ tri-plicatâ.*

Shell of a lengthened oval form, longitudinally ribbed, transversely furrowed, deeply notched at the base; spire elevated with a small pointed apex: whorls slightly convex, with the sutural margins depressed so as to form a narrow flat space, which runs round the spire; furrows numerous and regular until they approach the shoulder of the whorl, where the last three or four become gradually wider; the longitudinal ribs, which are more or less numerous in different individuals, extend almost to the very base of the whorl, and are surmounted by several rows of short tooth-like spines rising out of the spaces which separate the posterior furrows. The outer lip is smooth within, and crenulated on the margin by the transverse sulci; the inner lip is but slightly spread out, and does not extend backwards beyond the suture; the columella bears three very oblique folds, of which the anterior one is the largest.

This species was founded on a shell from the neighbourhood of London; it occurs also at Bracklesham Bay, but in the specimens from that locality the spire is not so elevated, and the shell is altogether shorter and broader.

The French shells referred by Lamarck to Brander's *Strombus ambiguus*, belong to the present species; but in them, as in the Bracklesham Bay shells, the spire is less elevated, and the shell is broader. In other respects they agree with the type.

A beautiful series of this Volute was obtained from the Artesian well at Southampton by Mr. Keele, for the use of which I am indebted to the kindness of that gentleman. One of this series is represented by figs. 2 *c, d;* figure 2 *b* is taken from a specimen from Highgate.

M. Rouault has described some shells from Bos d'Arros, in the neighbourhood of Pau, which he considers to be varieties of Lamarck's *V. ambigua*; but, judging from the figures given, they appear to be equally distinct from that species, and from Solander's *Stromb. ambiguus.* M. D'Archiac merely records the species without figure or description; but one of the localities given by him is Bos d'Arros, and the shells to which he refers may, therefore, belong to the same species as those described by M. Rouault. I have on this account cited his work, as well as that of M. Rouault, with a query. The shells from Dax and its neighbourhood, figured by Grateloup, D'Orbigny considers to belong to a distinct species, which he has named *V. sub-ambigua;* but, judging from the figures and from the only specimens I have seen from that locality, they appear to belong to Lamarck's *V. ambigua,* and I retain them as identical with the present species, although presenting some trifling differences.

*Size.*—Axis, 1 inch and 9-10ths; diameter not quite 9-10ths of an inch.

*Localities.*—Highgate, Camden Town, Hornsey, Nuneham, Southampton, and Bracklesham Bay. *French:* Rétheuil, Cuise-Lamotte, Dax, Gaas, Lesbarritz, (fide Grat.), Biaritz, Bos d'Arros, Les Corbières (fide D'Arch.), Valognes? (fide Rouault)?

### No. 92. VOLUTA CRENULATA. *Lamarck.* Tab. XX, figs. 1. *a—b.*

VOLUTA CRENULATA. *Lamk.* 1802. Ann. du Mus., vol. i, p. 478, No. 8. vol. xvii, p. 77, No. 9.
— — *Ib.* 1816. Tableau Encyc. et Méth., t. 384, fig. 5.
— — *Ib.* 1822. Hist. natur., &c., vol. vii, p. 351, No. 9.
— — *Defr.* 1829. Dict. des Sci. nat., vol. lviii, p. 476.
— — *Desh.* 1833. Encycl. méthod. (Vers,) vol. iii, p. 1145, No. 28.
— — *Ib.* 1824-37. Descr. des coq. foss., &c., vol. ii, p. 693; t. 93, fig. 5—9.
— — *Bronn.* 1838. Lethæa geognost., p. 1106; t. 42, fig. 4.
— — ? *Brogn.* 1823. Sur les terr. &c. du Vicent., p. 63.
— — ? *Bronn.* 1831. Ital. Tertiärgeb., &c., p. 18, No. 55.
Non. — — *Sow.* 1850. Dixon's Geol., &c., of Sussex, t. 5, fig. 22.

*V. testâ oblongo-ovatâ, costas longitudinales creberrimas, acutas, dentato-crenatas, ad basin tendentes et sulcis transversis numerosis decussatas, gerenti, anticè parum emarginatâ; spirâ brevi, sub-turritâ, apice acuto: anfractibus ventricosis, superne bi-canaliculatis, duplici serie spinarum dentiformium coronatis; columellâ quadriplicatâ.*

Shell ovate-oblong, rather ventricose, transversely furrowed, longitudinally ribbed, and but slightly notched in front; spire short, with a small pointed apex: whorls convex, depressed at the sutural margin, presenting a narrow channel round the spire, crowned by a double row of short, erect, pointed spines, which correspond with the posterior extremities of the ribs; the ribs, which are crowded, narrow, and extend to the very base, are cancellated by deep, transverse furrows, and at the points of section rise into tubercles, which, near the base of the whorl, are short and nodiform, but which, as they approach the posterior margin, become gradually elevated and sharp, until at length the tubercles between the last three or four furrows assume almost the character of the spines which crown the whorls. The transverse furrows are numerous, and the last, which separates the two rows of spines, is much wider than the others. The aperture is moderately wide; the outer lip thin and crenulated on the margin by the furrows, but smooth within; the inner lip spread widely over the body whorl, extending backwards a little beyond the aperture; the columella presents four not very oblique folds, of which the anterior one is the largest and most prominent, and the posterior two are feeble.

In the French specimens of this beautiful Volute the ribs are more numerous and stronger, and the tubercles at the points of decussation are consequently more nodiform, and are less elevated than in the English shells. A similar variance characterises the French *V. digitalina*, as I have before observed, and as our specimens of the present species agree very well in other respects with the French shells, I can only regard them as a local variety.

It is this species which the recent *V. abyssicola* most nearly resembles; but although that interesting shell presents a striking analogy with it, the much closer, more sharply defined, and more delicate character of the cancellation which ornaments the surface, the shorter spire, the more oblique and more slender columellar folds, and the less expanded inner lip sufficiently distinguish it.

Brogniart, in his list of fossil shells from the tertiary formations of the Vicentin, mentions the present species, but remarks that it approaches more nearly to the Barton form than to that from the Paris Basin; an observation which is repeated by Defrance. As *V. digitalina* is the Barton Volute which presents the nearest affinity to *V. crenulata*, it is to that species I presume that these authors refer; it is doubtful, therefore, whether the Vicentin shells ought not to be referred to *V. digitalina* rather than to the present species, and as I have not had an opportunity of examining any specimens, I have cited the Italian Volutes, but with doubt. The shell represented by fig. 22 (t. 25) in Mr. Dixon's work, and referred by Mr. Sowerby to this species, appears to me, as I have already observed, to belong to *V. digitalina*.

*Size.*—

*Localities.*—Bracklesham Bay. *French*: Parnes, Grignon, (fide Desh.). *Italian*: Ronca, Val Salgonini, (fide Bronn et Brogn.)?

### No. 93. VOLUTA SOLANDRI. *F. E. Edwards.* Tab. XX, figs. 6. *a—d.*

STROMBUS LUCTATOR, *Soland.* 1766. Brand. Foss. Hant., p. 30; t. 5, fig. 65.
VOLUTA SPINOSA, *Webster.* 1814. Geol. Trans., 1st ser., vol. ii, p. 204.
— — *Sow.* 1816. Min. Con., vol. ii, p. 30, t. 115, fig. 2—4.
— — *Morris.* 1843. Cat. Brit. Foss., p. 168.

*V. testâ ovato-oblongâ, longitudinaliter costatâ, transversim sulcatâ; spirâ mediocri,* *apice acuto: anfractibus ventricosis, biná serie spinarum armatis; spatio inter series concavo: aperturá ovato-elongatá, in medio effusá, anticè parum coarctatá; labro tenui, simplici; labio expanso, posticè incrassato; columellá leviter arcuatá, bis vel ter plicatá.*

Shell oblong, ventricose, longitudinally ribbed, transversely furrowed; spire moderately elevated, with a small pointed apex; the ribs, which are more or less numerous in different specimens, extend over nearly the whole length of the whorls, and terminate posteriorly in a row of erect, sharp spines. Close to the edges of the whorls rises a second row of smaller spines, the space between it and the suture forming a channel round the spire more or less deep, according to the height of the spines. The two rows of spines are connected by raised lines, and the intermediate space is concave. On the last whorl or two of the fully formed shell, the second row of spines frequently becomes obsolete, and is replaced by a sharp, elevated ridge. The furrows, in young specimens, extend over the whole surface of the whorl, but, as the shell advances towards maturity, the posterior ones become faint, and at length are frequently almost obliterated. The mouth is contracted in front, effuse near the middle, and deeply notched at the base. The outer lip is in all stages of growth thin, sharp-edged, and quite smooth within; the columellar lip is moderately spread out over the body whorls, and thickened behind, and does not extend backwards beyond the suture. The columella, which is slightly arched, presents in the young state, two unequal, not very oblique plaits, in front of which a third obscure plait generally appears at maturity.

Brander's shell (fig. 65), referred by Solander to *V. luctatrix*, and by Lamarck to *V. spinosa*, presents nevertheless characters sufficiently distinct to entitle it, as Mr. Sowerby long ago suggested, to be considered as belonging to a separate species. In addition to the distinction afforded by the rows of spines, which are more equal and more permanent in this species than usual, it will be seen, on comparison with *V. luctatrix*, that in *V. Solandri* the shell is shorter and broader, the spire not so much elevated, the outer lip always sharp edged, and without plication, the inner lip not so effuse, the columella arched, and the columellar folds neither so numerous nor so large; and, on a comparison with *V. spinosa*, that the shell is not so turbinate, the spire more elevated, and the whorls more ventricose.

*Size.*—Axis, 2 inches nearly; diameter, rather more than 1 inch.

*Locality.*—Barton.

### No. 94. VOLUTA SCALARIS. *Sowerby*. Tab. XX, figs. 5 *a*—*c*.

VOLUTA SCALARIS, *Sow.* 1843. Min. Con., vol. vii, p. 32; t. 625, fig. 4—5.

*V. testá ovatá, ventricosá, anticè attenuatá; spirá elevatá, apice acuminato: anfractibus costatis, biná serie spinarum coronatis, transversim sulcatis, ad margines suturales depressis, inter series spinarum concavis; costis numerosis; sulcis sub-distantibus, æqualibus: labro simplici, acuto; labio parum expanso; columellá sub-rectá, triplicatá.*

Shell ovate, very ventricose, much attenuated and deeply notched in front; spire elevated; apex pointed. The whorls, six or seven, longitudinally ribbed, transversely furrowed; ribs numerous and sharp in young specimens, more distant and rounded in mature shells, and crowned with a double row of erect, sharp, nearly equal spines; the furrows, which are rather distant and regular, extend up to the front row of spines, but in fully formed shells often become obliterated over the posterior part of the last whorl. A narrow flat border runs round the whorls between the suture and the second row of spines, and the space between the two rows is concave. The outer lip is thin, sharp, and quite smooth within; the inner lip is not much spread out, and does not extend backwards beyond the suture; the columella, which is slightly curved, presents three folds.

This shell so closely resembles *V. Solandri* that it may, perhaps with greater propriety, be regarded as a dwarf variety of that species, rather than as being distinct from it. It is, however, more ventricose, with a longer spire and more nearly equal spines; the inner lip is less spread over the ventral surface of the body whorl, and the notch is not so deep.

The species occurs in abundance at Highcliff, but in the specimens from that locality the spines are blunt, almost nodiform, and the furrows more numerous. The same variety occurs at Alum Bay, and occasionally, though rarely, at Barton.

*Size.*—Axis, 1 and 2-10ths of an inch nearly; diameter, 7-10ths of an inch.

*Localities.*—Barton, Highcliff, Alum Bay (Strat. No. 29, Prestwich).

### No. 95. VOLUTA RECTICOSTA. *Sowerby.* Tab. XX, fig. 3.

VOLUTA RECTICOSTA. *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 188; t. 5, fig. 18.

*V. testâ ovato-oblongâ, costatâ, transversim sulcatâ, anticè subrostratâ, parum emarginatâ; spirâ mediocri apice acuto: anfractibus ventricosis, duplici serie spinarum coronatis; spatio inter series spinarum concavo; costis numerosis, rectis, tenuibus, primam seriem spinarum gerentibus; labro tenui.*

Shell oval-oblong, ribbed, transversely furrowed; spire moderately elevated, terminating in a small pointed apex; whorls ventricose, contracted rather suddenly in front, so as to give a beak-like form to the base, crowned with two not very distant rows of short, erect, sharp spines; ribs numerous, thin, straight, scarcely extending beyond the middle of the whorl, and each terminating in a spine; the margins of the whorls between the two rows of spines concave. The outer lip thin, sharp edged, and smooth within. The basal furrows are strongly marked, and extend higher up the whorl than is usually the case. The notch in front is not deep.

The figure is taken from the original specimen described and figured by Mr. Sowerby; this specimen, which forms part of Mr. Dixon's collection, is unfortunately somewhat crushed and distorted. No traces of the inner lip remain, and the aperture is filled with the matrix, so that the columellar folds cannot be seen. Mr. Sowerby, in his description, expressed an opinion that this shell might probably be the same as *V. ambigua* (*Lamk.*); the two rows of spines and the hollow space between them, however, appear to distinguish it. I am more inclined to refer it to *V. scalaris*, or to regard it as a young shell of *V. solandri;* but the short spire, numerous straight ribs, and the deep basal furrows distinguish it apparently from the former; while these characters, as well as the general form of the shell, which is more ventricose and more contracted in front than in *V. solandri*, appear to separate it from the latter species. A young specimen from Stubbington, in M. D'Urban's collection, presents the same characters as the one figured; and additional specimens may establish the species; in the meantime I retain it, but with some doubt.

*Size.*—Axis, 1 inch and 2-10ths; diameter, 6-10ths of an inch.

*Localities.*—Bracklesham Bay, Stubbington.

### No. 96. VOLUTA SUSPENSA. *Solander*. Tab. XX, figs. 4 *a—c*.

MUREX SUSPENSUS. *Soland.* 1766. Brand. foss. Hanton., p. 32; t. 5, fig 70.
VOLUTA CRENULATA. *Webster.* 1814. Geol. Trans., 1st series, vol. ii, p. 204.
— AMBIGUA, VAR. MONSTROSA. *Sow.* 1816. Min. Con., vol. ii, p. 31; t. 115, fig. 5.
— SUSPENSA. *Sow.* 1823. Min. Con., vol. iv, p. 137.

*V. testá ovato-oblongá, sub-turritá, costatá, transversim sulcatá, ad basin sub-productá, parum emarginatá; spirá elevatá, acuminatá, canali lato, marginibus anfractuum repente inflexis septo, circumdatá: anfractibus sub-ventricosis, dentato-crenatis; costis obscuris, distantibus, uná serie spinarum coronatis: aperturá postice acute angulatá, antice coarctatá; labro simplici tenui; columella biplicatá.*

Shell oval-oblong, turreted, ribbed, transversely furrowed; spire elevated, pointed; whorls somewhat ventricose, the posterior margins suddenly bent inwards, forming round the spire a broad deep canal, bounded by a sharp denticulated ridge. The ribs, numerous in the young shells, but becoming more distant towards maturity, extend nearly to the base of the whorl, and terminate posteriorly in sharp, tooth-like spines. At the posterior extremities of the ribs, the whorl is depressed, and presents a narrow flat space, which forms, as it were, a platform from which the sharp ridge bounding the spiral canal rises. The furrows at the base are broad and rounded; the others distant and angular. The aperture is contracted, and produced in front, wide in the middle, sharply angulated behind; the outer lip thin and smooth within: the columella nearly straight, presenting two very unequal folds.

This is the rarest of the Barton Volutes; it may be readily distinguished by the broad deep channel which runs round the spire.

*Size.*—Axis, 3 inches; diameter, 1 inch and 6-10ths.

No. 97. **Voluta tricorona.** *Sowerby.* Tab. XX, figs. 7 *a—d.*

Voluta tricorona. *Sow.* 1843. Min. Con., vol. vii, p. 6; t. 613, fig. 2.

*V. testâ ovato-rhomboidali, costatâ, transversim sulcatâ, antice profunde emarginatâ; spirâ brevi, apice acuto; anfractibus obtuseangulatis, triplici serie spinarum nodiformium coronatis; costis numerosis, angustis, fere ad basin tendentibus; sulcis transversis irregularibus, lineis incrementi decussatis: aperturâ elongato-ovâli, postice subcanaliculatâ; labro simplici, lævi; labio effuso; columellâ biplicatâ.*

Shell rhomboidal-ovate, longitudinally ribbed, transversely furrowed; spire short, apex small, pointed: whorls bluntly angulated at the shoulder; ribs rather numerous, narrow, extending almost to the base, and surmounted by three rows of short nodiform spines; furrows rounded, shallow, crowded and irregular on the posterior part of the whorl, deep, distant, and regular towards the base; decussated by thick conspicuous lines of growth: aperture of a lengthened ovate shape, deeply notched in front, and terminating behind in a short, wide canal; outer lip thin, smooth within; columella nearly straight, flattened on the anterior surface, and furnished with two folds, of which the front one is thick and very oblique. Only imperfect traces of the inner lip remain in the specimens I have seen, but it was apparently widely spread, covering the front of the body whorl, and stretching backwards far up the spire.

This Volute, which appears to be peculiar to the lower formations, is very rare. In the general form it resembles *V. denudata* so much that a worn individual might easily be mistaken for one of that species. The *V. denudata* is, however, distinguished by its single row of thick nodiform tubercles, the rounded dome-like shape of the posterior margin, and the smooth upper surface of the body-whorls. Fig. 7 *d* is taken from the original specimen figured in 'Mineral Conchology.' This, and also the specimens represented by figs. 7 *a, e,* form part of Mr. Wetherell's collection.

*Size.*—The largest specimen I have seen has lost the upper part of the spire, but when perfect, the dimensions would have been, axis, 2 inches, nearly; diameter 1 and 1-10th of an inch.

*Localities.*—Primrose Hill, Copenhagen Fields, Potter's Bar.

No. 98. **Voluta pugil.** *F. E. Edwards.* Tab. XXII, figs. 1 *a—c.*

Voluta spinosa. *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 107; t. 5, fig. 16.
— — var. platyspina. *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 107; t. 7, fig. 29.

*V. testâ ovato-oblongâ, antice attenuatâ, obscure costatâ, transversim sulcatâ; spirâ brevi, apice acuto: anfractibus convexiusculis, unicâ serie spinarum coronatis; spinis magnis, dis-*

*pansis; sulcis transversis distantibus, ad basin latis, profundis: aperturâ postice sub-canaliculatâ, antice late emarginatâ; labro tenui, simplici; labio effuso, postice incrassato; columellâ arcuatâ, quater vel quinquies plicatâ.*

*Var?* PLATYSPINA, *fig.* 1 *c.* *Testâ tuberculis nodiformibus, crassis, lateraliter compressis, coronatâ.*

Shell ovately oblong, contracted at the base, obscurely ribbed, transversely furrowed, with a short, rather conical, and pointed spire: whorls angulated at the shoulder, and crowned with a single row of large, wide-spreading spines. The bases of the spines are prolonged into thick, obscure ribs, which do not extend beyond the middle of the whorls. In the young state, the ribs are numerous, and surmounted by two rows of small, sharp spines; as the shell increases in size, the ribs become more distant, and the row of spines nearest to the suture disappears, and is replaced by a sharp, elevated ridge. The transverse furrows are distant, and broad and deep at the base. The aperture is contracted in front, obscurely channelled close to the suture, and widely, but not deeply, notched in front; outer lip thin, sharp edged, and smooth within; inner lip widely spread, thickened posteriorly, and extending backwards as far as the suture; columella flattened in front, curved, and furnished with four or five folds, of which the one in front is the largest. In the last whorls, the sutural margin is spread over the preceding whorl up to the spines, which, in some instances, are covered by it.

In the specimen represented by fig. 16, tab. 5, in Mr. Dixon's work, the outer lip is broken off, and the shell consequently presents the turbinate form which characterises *V. spinosa* (Lamk.); and this circumstance probably induced Mr. Sowerby to refer it to that species; from which, however, it is distinguished by the transverse furrows, and the arched and flattened columella.

In the specimen (fig. 1 *c*) for which the variety *platyspina* was proposed by Mr. Sowerby, the spines on the last whorl are converted into large, thick, laterally-compressed, knob-like tubercles. The animal had, apparently, attained great age; and, as I am not aware of any similar specimen having been found, I am inclined to regard the individual in question as a monstrosity rather than as a variety.

The present shells much resemble *V. athleta* in the character of the spines, and in the conditions of the inner lip and the columellar folds; but the deep transverse furrows, which continue to be strongly marked even in adult specimens, entitle them, apparently, to specific distinction.

*Size.*—Axis, ; diameter,

*Locality.*—Bracklesham Bay.

*Section A.* (*Pullus small, conical.*
*a. Shell turbinate or pyriform; costated or coronated; inner lip effuse; columellar plaits few.*) } *continued.*

*β. Transversely furrowed at the base only.*

No. 99. VOLUTA ATHLETA. *Solander.* Tab. XXI, figs. 7 *a—e.*

STROMBUS ATHLETA. *Soland.* 1766. Brand. Foss. Hanton., p. 31; t. 5, fig. 66.
VOLUTA — *Sow.* 1823. Min. Con., vol. iv, p. 133; t. 396, figs. 1—3.
— — *Defr.* 1829. Dict. des Sci. nat., vol. lviii, p. 480.
— — *Desh.* 1824-37. Desc. des coq. foss., vol. ii, p. 689; t. 93, figs. 12—13.

*V. testâ rhomboidali, spinis magnis dispansis coronatâ, ad basin sub-profunde emarginatâ; spirâ brevi, acuminatâ: anfractibus postice lævibus, ad basin obsolete transversim sulcatis: aperturâ effusâ; labro tenui, simplici; labio parum effuso, postice incrassato; columellâ depressâ, leviter arcuatâ, tri-plicata.*

*Var.* FORTIS (*tab.* 21, *fig.* 7 *e*) *testâ ovato-turbinatâ, breviori, latiori; anfractibus antice valde attenuatis.*

Shell rhomboidal, crowned with large spreading spines, and widely, but not deeply, notched at the base; spire rather short and pointed. In young individuals, the whorls are transversely furrowed, obscurely ribbed, and surmounted by two rows of short, erect spines; but as the shell approaches maturity, the ribs become effaced, the second, or sutural row of spines disappears, and is replaced by an irregular sharp elevated line, and the spines of the first row become large, distant, and spreading; the transverse furrows disappear after the first three or four whorls, and the shell is afterwards smooth, except at the base, where a few faint, almost obsolete, transverse furrows appear. The aperture is elongate, and rather wide; the outer lip smooth and simple; the inner lip moderately spread over the body whorl, thickened at the upper part, and not extending backwards beyond the suture; columella flattened in front, slightly curved, and presenting one broad prominent fold in front, and two or three others, small and indistinct, behind.

A variety occurs at Highcliff, which appears to correspond with the shell described by M. Deshayes, more closely than do the Barton shells; it is more turbinate, shorter, and comparatively wider than the type, and the whorls are much attenuated in front.

The smooth and ventricose body and flattened columella distinguish this species; and at maturity, the large spreading spines give a strongly marked character to it.

*Size.*—Axis, 3 inches, nearly; diameter, 1 inch and 7-10ths, nearly.

*Localities.*—Barton, Alum Bay (No. 29, Prestwich). For the variety, Highcliff. *French:* Monneville, Houdan (fide Desh.).

## No. 100. VOLUTA DENUDATA. *Sowerby*. Tab. XXI, figs. 5 *a—c*.

VOLUTA DENUDATA. *Sow.* 1840. Min. Con., vol. 7, p. 6; t. 93, fig. 3.
— — — 1850. Dixon's Geol. Suss., p. 120; t. 15, fig. 7.

*V. testá ovato-oblongá, postice lævi, antice transversim sulcatá, profunde emarginatá; spirá conicá, brevi, apice acuto; costis brevibus, crassis, ad extremitates posteriores nodigeris; anfractu ultimo superne concamerato: aperturá elongato-ovali, postice angustá; labro simplici, intús lævi; labio expanso, incrassato; columellá tri-plicatá.*

Shell oblong-ovate, ribbed, smooth, except towards the base, where it is transversely furrowed; spire short, conical; apex small, pointed; ribs thick, short, scarcely extending to the middle of the whorl, and terminating posteriorly in coarse, nodiform tubercles; whorls rather ventricose in front, obtusely angulated at the shoulders; the space between the tubercles and the suture convex, imparting a dome-like shape to the lower part of the spire. The aperture is of a lengthened oval form, narrow, obscurely channelled behind, widely and deeply notched in front; the outer lip simple, smooth within; inner lip much spread over the front of the body whorl, extending backwards far up the spire, and thickened. The columella is flattened in front, and presents one thick, prominent fold in front, and two or three smaller ones behind. In the young shell, the whorls are crowned with three rows of small, nodiform spines, and the margins between the front row and the suture are somewhat depressed. The two posterior rows, which correspond with the front row, rise out of faint, elevated lines, which traverse the sutural margin; as the shell is enlarged, these spines are lost, and the transverse lines become stronger; the direction of the suture also becomes less decurrent, so that each succeeding whorl envelops more of the preceding one, and the margin of the last, in fact, covers the front row of spines upon the whorl next to it; the margins also become convex, and assume the dome-like shape characteristic of the later whorls.

*Size.*—Axis, 3 inches, nearly; diameter, 1 and 7-10ths of an inch, nearly.

*Localities.*—Bognor, where it is very common, and (*fide Sow.*) Brentford.

## No. 101. VOLUTA SPINOSA. *Linnæus*. Tab. XXI, figs. 4 *a, b*.

*Lister.* Hist. Conchyl., t. 1033, fig. 7?
*Gualtieri.* 1742. Index Test. Conch., t. 55, fig. E?
CONUS SPINOSUS. *Linn.* 1758. Syst. Nat., 10th edit., p. 715, No. 271.
BUCCINUM (SP.) *Walch.* 1764. Das Steinreich System., &c., t. 11, fig. 2 *a*.
STROMBUS SPINOSUS. *Linn.* 1767. Syst. Nat., 12th edit., p. 1212.
— — *Favanne.* 1780. D'Argen. Conchyl., 3d edit., t. 66, fig. I, 9.
— — *Schröter.* 1783. Einleit. in die Conch., vol. 1, p. 443, No. 24.
— — *Gmel.* 1788. Linn. Syst. Nat., 13th edit., p. 3518, No. 27.

STROMBUS SPINOSUS. *Chemn.* 1795. Conchyl. cab., vol. xi, t. 212, figs. 3002—3.

VOLUTA SPINOSA. *Lam.* 1802. Ann. du Mus., vol. i, p. 477, No. 2, and vol. xvii, p. 74, No. 2.

— — *Roissy.* 1804. Buff. Moll., vol. v, p. 440, No. 7.

— — *Lam.* 1816. Tableau Encyclop. et Méth., t. 392, fig. 5 *a*—*b*.

— — — 1822. Hist. Nat., vol. vii, p. 348, No. 2.

— — *De France.* 1829. Dict. des Sci. Nat., vol. lviii, p. 474.

— — *Desh.* 1832. Encycl. Méthod. (Vers), vol. iii, p. 1143, No. 22.

— — — 1824—37. Desc. des Coq. Foss., vol. ii, p. 690; t. 92, figs. 7—8.

— — ? *Galeotti.* 1837. Mém. sur la Const. Géog., &c., de Brabant, p. 149, No. 71, t. iii, fig. 16.

— — ? *Nyst.* 1843. Coq., &c., de Belg., p. 589.

— — *Morris.* 1843. Cat. Brit. Foss., p. 168.

— — ? *Philippi.* 1851. Palæontogr. Tert. Foss. Magdeb., p. 78, No. 169.

Nec. — — *Sow.* 1816. Min. Con., vol. ii, p. 30; t. 115, figs. 2—4.

nec. — — — 1850. Dixon's Geol., &c., of Suss., p. 107; t. 5, fig. 16.

nec. — — var. PLATYSPINA. *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 107; t. 5, fig. 29.

*V. testâ turbinatâ, ad basin transversim striatâ, longitudinaliter partim costatâ; anfractibus acute angulatis, unicâ serie spinarum coronatis; spirâ brevi, apice acuto; labro tenui, simplici; columellâ quadri-plicatâ.*

Shell turbinate, resembling in shape two unequal cones placed base to base, the smaller of which is formed by the short pointed spire; whorls nearly straight, longitudinally ribbed, much narrowed in front, and acutely angulated at the shoulder; the margin between the spines and the suture rather concave. The ribs, which extend only about half-way over the whorl, terminate at the shoulder in a row of short, pointed spines. The sutural margin is bordered by an elevated line, which, occasionally, in young shells, rises into small, pointed tubercles opposite to the spines. The whorls at the base are traversed by several oblique furrows, which disappear towards the middle of the shell, where the ribs take their rise. The mouth is narrow, and somewhat quadrilateral, owing to the angularity of the upper part of the whorl; the outer lip thin and smooth within; inner lip but little spread out. The columella, which is rather flattened in front and nearly straight, presents one large prominent plait in front, and three, sometimes four, feeble ones behind and, according to M. Deshayes, a large smooth callus at the posterior extremity formed by the thickening of the inner lip.

The shells from Barton, described by Mr. Sowerby (loc. cit.), and referred by him to this species, present characters sufficiently distinct, as I have before observed, to require that they should be separated. I have not met, in fact, with any shell from the Hampshire beds corresponding with the true *V. spinosa* of the Paris basin, unless the *V. depauperata* be regarded as a local variety; but the species occurs not unfrequently at Bracklesham Bay.

The French specimens are generally ornamented with numerous pale orange-coloured bands; but the English matrix has been less favorable for the preservation of the colouring matter, and specimens retaining traces of the original marking are very rare.

The shells described in Mr. Dixon's work as *V. spinosa,* and *V. spinosa,* var. *platyspina,* (p. 107, t. 7, f. 22,) do not belong to this species; nor, apparently, do those described by Galeotti from St. Josse-ten-Noode, St. Gilles, Forêt, and Afflighem in Brabant; in them, the ribs are thick, round, and prominent; and the whole surface presents a transverse sculpture. Philippi records a specimen of the present species from Westeregeln, in the Museum at Halle; but as Dr. Beyrich does not mention the species among the Volutes described by him from that locality, I have cited Philippi with a query.

*Size.*—Axis, 1 inch and 3-10ths; diameter, nearly 8-10ths of an inch.

*Localities.*—Bracklesham Bay; Southampton. *French:* Grignon, Courtagnon, Parnes. *German:* Westeregeln in Magdeburg (fide Phil.)?

### No. 102. VOLUTA DEPAUPERATA. *Sowerby.* Tab. XXI, figs. 8 *a—c.*

VOLUTA DEPAUPERATA, *Sowerby.* 1823. Min. Con., vol. iv, p. 133, t. 396, fig. 4; vol. vii, p. 32, t. 625, fig. 6.
— — *Defr.* 1829. Dict. des Sci. nat., vol. lviii, p. 481.
non — — *Desh.* 1824-37. Desc. des coq. foss., &c., vol. ii, p. 684, t. 92, figs. 5, 6.

*V. testâ ovato-oblongâ, partim costatâ, antice transversim sulcatâ, postice lævi; spirâ brevi, apice acuto; anfractibus sub-ventricosis, postice acute angulatis, unâ serie spinarum donatis, margine suturali sub-convexo: labro simplici, tenui; labio parum expanso; columellâ biplicatâ.*

Shell oval-oblong, longitudinally ribbed, transversely furrowed in front, otherwise smooth, with a short pointed spire: whorls rather ventricose, acutely angulated at the shoulder. The ribs, which are not numerous, extend over about two thirds of the whorl, and terminate at the shoulder in a row of short erect spines. In young shells a second row of small pointed tubercles, corresponding with the spines, runs round the suture; but they soon disappear, and generally are replaced by an irregular raised line. The margin of the whorls, between the shoulder and the suture is slightly convex. The aperture is of a lengthened-oval shape, rather effuse and widely but not very deeply notched in front; the outer lip thin and smooth; the inner lip but slightly spread out; the columella rounded, nearly straight, and furnished with two unequal folds. The surface of the shell is ornamented with transverse, narrow, orange-coloured bands, resembling those in the French specimens of *V. spinosa*, with which species the present one is closely analogous, and of which it appears to me to be merely a local variety. It is in fact, only distinguished by the more ventricose whorls, the more effuse aperture, the rounded columella, and the greater obliquity of the columellar folds.

Brander's shell (fig. 67), referred by Mr. Sowerby to this species, belongs to *V. luctatrix;* and the French shells which M. Deshayes has described as *V. depauperata* also appear to be quite distinct; they are longer, narrower, and more regular in form, and have a more elevated and thicker spire; and the surface of the whorl is obscurely striated.

*Size.*—Axis, 1 inch and 9-10ths; diameter, not quite 1 inch.

*Localities.*—Barton (fig. 8 *a*), and the fluvio-marine formation at Hordwell, and at Colwell Bay (figs. 8 *b, c*), in which latter place it occurs in abundance.

## No. 103. VOLUTA GEMINATA. *Sowerby.* Tab. XXI, figs. 3 *a, b.*

VOLUTA GEMINATA, *Sow.* 1823. Min. Con., vol. iv. p. 136; t. 398, fig. 1.

*V. testâ ovatâ, ventricosâ, antice coarctatâ, costatâ, sub-turritâ; spirâ mediocriter elevatâ, apice acuto; anfractibus postice lævibus, ad basin transversim sulcatis, ad margines suturales depressis; costis pro-eminentibus, sub-crassis, postice binâ serie spinarum nodiformium coronatis; aperturâ oblongo-ovali, antice angustiori; labro tenero, simplici; labro late expanso, postice incrassato; columellâ arcuatâ, tri-plicatâ.*

Shell ovate, ventricose, contracted towards the base, ribbed; spire moderately elevated, apex very small, pointed; whorls five or six, smooth on the middle and at the posterior extremities, transversely furrowed toward the base, and flattened at the sutural margin; ribs prominent, rather thick, rounded, extending to the transverse furrows, and surmounted by two rows of short, erect, connected, nodiform spines, with a rounded, depression between them; the flattened margins of the whorls form a shallow obscure channel round the spire, imparting to it a turret-like aspect. The aperture is of a lengthened-oval shape, narrowing toward the base; the outer lip thin, sharp, and smooth within; the columellar lip much spread out over the body-whorl, but not extending backwards beyond the suture; the columella much curved, and furnished with three oblique folds.

The present species appears to be confined to the neighbourhood of Lyndhurst, where it was first discovered many years ago by Sir Charles Lyell.

*Size.*—Axis, rather more than 1 inch and 3-10ths; diameter, 7-10ths of an inch, nearly.

### No. 104. VOLUTA HORRIDA. *F. E. Edwards.* Tab. XXI, figs. 2 *a—c.*

*V. testá oblongo-ovatá, costatá, postice lævi, antice transversim sulcatá; anfractibus duplici serie spinarum dentiformium donatis; costis numerosis, lateraliter compressis, fere ad basin tendentibus, postice tuberculatis et in mucrones primam seriem spinarum formantes, prolongatis; sulcis transversis latis, profundis, costas fortiter decussantibus; spatio inter series spinarum concavo; labro tenui, simplici; columellá uniplicatá.*

Shell ovate-oblong, armed with two rows of short, upright, pointed spines, ribbed, smooth behind, transversely furrowed in front; ribs numerous, thick, angular, compressed sideways toward the aperture and terminating posteriorly in sharp conical points forming the front row of spines. The ends of the ribs, immediately in front of the spines present a rounded depression at the anterior margin of which they rise into small tubercles. The transverse furrows are wide and deep, strongly decussating the ribs. The posterior margins of the whorls, between the rows of spines, are sunken and concave; the outer lip is thin, sharp-edged, smooth within?; the columella presents a single very oblique fold.

The sharp erect conical spines and the prominent ribs, deeply cut by the transverse furrows are characters so distinct, that I am unwilling not to record the species, although the only specimen I possess has lost the spire and is otherwise imperfect. It appears to be a young shell, and the actual character of the outer lip cannot be stated with certainty; there are not any traces of the columellar lip preserved.

*Size.*—Axis, (without the spire) ½ inch, nearly; diameter, rather less than 3-10ths of an inch.

*Locality.*—Bracklesham Bay; very rare.

### No. 105. VOLUTA FORBESII. *F. E. Edwards.* Tab. XXI, figs. 1 *a—d.*

*V. testá turbinatá, costatá, postice lævi, antice transversim sulcatá; spirá elevatá, apice acuto; costis sub-distantibus, vix ad sulcos tendentibus, postice in tuberculos lateraliter compressos elevatis, deinde biná serie brevium spinarum coronatis; aperturá elongato-ovali, angustá, postice sub-canaliculatá, antice late emarginatá; labro intús incrassato, ad marginem acuto; labio effuso; columellá rectá, biplicatá.*

Shell turbinate, ribbed, transversely furrowed at the base, smooth behind; spire elevated, pointed, with a small conical apex; ribs rather distant, extending scarcely beyond the middle of the whorls, rising at the posterior extremities into large, prominent, laterally compressed tubercles, and crowned with a single row of short, erect, tooth-like spines. The sutural margin is depressed and bordered by a raised line, which occasionally rises into minute pointed tubercles; aperture of a lengthened oval form, narrow, obscurely channelled behind, and widely notched in front; the outer lip thickened within, thin and sharp at the edge; inner lip moderately spread over the body-whorl, and presenting at the suture a callus-like thickening, which forms the left side of the posterior canal; the columella nearly straight, and furnished with two or three not very oblique folds, the front one of which is the most prominent.

The present species approaches closely to *V. geminata*, but is much more turbinate, resembling in general form *V. spinosa;* and the anterior tubercles are different in their character; in the present species they are simply an enlargement of the ribs themselves, while in *V. geminata*, a transverse line runs round the shoulder, and rises into tubercles where it crosses the ribs; the aperture in *V. Forbesii* is also narrow and more regularly ovate. This species is found in Hempstead Cliff; and I have dedicated it to the late much lamented Prof. E. Forbes, by whose researches the position of that formation in the tertiary series, so long misunderstood, has been ascertained.

*Size.*—Axis, 7-10ths of an inch; diameter, 4-10ths of an inch.

### No. 106. VOLUTA CALVA. *Sowerby.* Tab. XXI, figs. 6 *a*, *b*.

VOLUTA CALVA. *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 187; t. 7, fig. 28.

*V. testá pyriformi, antice transversim obsolete sulcatá, cæterum lævi, ad basin vix emarginatá; spirá brevi, conicá, apice acuto: anfractibus angulatis, unicá sine spinarum donatis, superne concavis, marginibus anfractu precedenti adpressis: aperturá elongato-ovali; labro tenui, simplici; labio parum effuso; columellá subrectá, bis vel ter plicatá.*

Shell pyriform, obscurely ribbed, slightly notched at the base, and presenting several faint, almost obsolete, transverse furrows in front, smooth elsewhere; spire short, conical, with a small pointed apex: whorls angulated at the shoulder, and crowned with a single row of short, pointed tubercles; the margins pressed against the spire; the space between the suture and the row of tubercles concave. The aperture of a lengthened oval shape; outer lip thin, sharp-edged, smooth within; inner lip very thin and but little spread out; and the columella furnished with two nearly equal folds in front, and a third very feeble one behind.

The specimens are generally simply coronated; but, in some instances, the elevated bases of the tubercles are prolonged into very short, faint ribs. The angulated shoulder and the tubercles distinguish this species from the young shell of *V. Selseiensis*, with which only it might be confounded.

*Size.*—Axis, 1½ inch, nearly; diameter, 7-10ths of an inch.

*Locality.*—Bracklesham Bay, where it is somewhat rare.

### No. 107. VOLUTA SELSEIENSIS. *F. E. Edwards.* Tab. XXII, figs. 3 *a—f*.

VOLUTA LABRELLA. *Sow.* 1840. Min. Con., vol. vii, p. 8; t. 614, fig. 2.
— — *Morris.* 1843. Cat. Brit. Foss., p. 167.
— — *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 187; t. 5, figs. 12—14.
BULBULA. — — — — — p. 186; t. 7, fig. 35.
nec. — LABRELLA. *Lamk.* 1802. Ann. du Mus., vol. i, p. 479, No. 10, vol, xvii, p. 74, No. 14.
nec. — BULBULA. *Lamk.* 1802. Ann. du Mus., vol. i, p. 479, No. 11.

*V. testá ovato-turbinatá, ventricosá, antice transversim sulcatá, cæterum lævi; spirá brevi, conicá, apice acuto: anfractibus prioribus costas et sulcos tranversos, sese decussantes, gerentibus; anfractibus cæteris unico sulco transverso prope margines suturales exaratis, marginibus ad spiram adpressis; peripheriá anfractuum primo convexá, deinde gradatim plus plusque rotundatá: aperturá elongato-rhomboidali, antice profunde emarginatá, postice sub-canaliculatá; labro postice incrassato, antice acuto, lævi; labio parum effuso, incrassato, postice magnum callum oblongum, anfractum a spirá separantem, formanti; columellá leviter arcuatá, compressá, biplicatá.*

Shell ovately turbinate, ventricose; spire short, conical, with a small, pointed apex; the first two or three whorls ornamented with numerous slender longitudinal ribs decussated by transverse furrows, which disappear rather suddenly at the third whorl; the whorls then become perfectly smooth, except towards the base, where they are traversed by broad more or less conspicuous furrows. The aperture is of an elongated rhomboidal form, deeply notched in front, and terminating posteriorly in an obscure channel; the outer lip smooth within, thickened behind, and stretching outwards into a wing-like projection; the middle and front parts thin and sharp-edged; the columellar lip but little spread out, and very much thickened, forming at the posterior extremity a large callus, which gradually separates the margins of the whorls more and more widely from the spire; the columella is curved, flattened, and furnished with two oblique, nearly equal folds, and sometimes with a third feeble and indistinct one behind. The middle whorls are convex at the shoulders, but as they become more and more detached from the spire by the increasing callus, the shoulders become more and more bluntly round.

The shells referred by Mr. Sowerby to *V. bulbula* are without doubt the young of the present species; but even in this state (figs. 2 *a*, *b*), although they much resemble the French shells, they present dissimilarities, which sufficiently indicate a distinct species. In *V. bulbula,* the shell is more fusiform, with a longer spire; the margins of the whorls are without the transverse furrow; the outer lip, even in the adult shell, is not thickened; the inner lip is very thin, more widely spread over the body-whorl, and without the thickening or callus which distinguishes the present species; the columella is nearly straight and round; the folds are more slender, and placed nearer the middle of the columella, and the basal furrows are fainter and more numerous, becoming, in fact, almost obsolete on the mature shell.

The present species certainly presents a close analogy with *V. labrella* (Lamk.) to which the adult shells have been referred; but a careful comparison will show, I think, that they are not a mere local variety of that species, but distinct from it. In *V. Selseiensis*, the whorl is more convex, and the general form of the shell is consequently more ovate and less turbinate; the shoulder is always obtusely rounded, and never presents the prominent keel which characterises *V. labrella*, nor even the angular periphery which, in some specimens, is substituted for the keel; the transverse furrows are lost after the very early whorls, while in the French species they are continued more or less distinctly until maturity. But the principal differences will be found in the condition of the lips; for in *V. labrella*, the outer lip is much less thickened, and does not assume the wing-like expansion found in the present species; the inner lip is more widely spread over the front of the body-whorl and, although thickened at the posterior extremity, does not form the large callus which, by separating the margin of the whorl from the spire, forms so conspicuous a character in *V. Selseiensis.*

*Size.*—Axis, 2 inches and 7-10ths nearly; diameter, rather more than 1 inch and 6-10ths.

*Locality.*—Bracklesham Bay, where it is not uncommon.

*Section A. (Pullus small, conical) continued.*

*b. Shell fusiform; costated, transversely striated; inner lip narrow.*

*a. Columellar plaits few.*

### No. 108. VOLUTA ANGUSTA. *Deshayes.* Tab. XXIII, figs. 3 *a, b.*

VOLUTA ANGUSTA, *Desh.* 1824-37. Desc. des Coq. Foss., vol. ii, p. 697; t. 94, figs. 5, 6.
— — *Sow.* 1844. Min. Con., vol. vii, p. 34, t. 626, figs. 1—3.
— — *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 107, t. 5, fig. 19 (non t. 7, fig. 37).

*V. testâ elongatâ, sub-fusiformi, angustâ, costatâ, ad basin late emarginatâ; spirâ productâ sub-conicâ, apice acuto: anfractibus depresso-convexiusculis, superne tenuissime striatis; ultimo anfractu spiram longitudine fere æquanti; postice tuberculoso-costatâ, ad basin lævi: aperturâ elongatâ, angustâ; columellâ rectâ, obscure triplicatâ; labro acuto, simplici; labio angusto.*

Shell fusiform, much elongated, narrow, ribbed, and widely but not very deeply notched at the base; spire conical, produced, nearly as long as the last whorl; apex small, pointed: whorls depressedly convex, ornamented with exceedingly fine transverse striæ; ribs distant, not prominent, extending to nearly the middle of the whorl, and rising at the shoulder into obtuse laterally compressed tubercles; the transverse striæ are lost on the middle and front parts of the last whorl, and are only faintly traceable towards the sutural margin. The aperture is elongated, narrow, with nearly parallel margins; the outer lip simple, sharp-edged, angular at the posterior extremity, smooth within; inner lip narrow; the columella is nearly straight, and, according to M. Deshayes, is furnished with three folds, of which one only is visible in front, but the other two are seen when the outer lip is broken.

The much-varying forms of *V. muricina,* suggested to M. Deshayes the probability that this might eventually prove to be merely a narrow variety of that species, to which in fact it bears a very strong resemblance: the transverse striation is common to both species, and much value, cannot, I think, be attributed to the greater or less number of the feeble posterior columellar folds. I should be strongly inclined, therefore, to regard this as a variety of *V. muricina*, were it not for the difference in the size of the pullus, which, in *V. angusta*, is much smaller than in *V. muricina;* and, as it is uncertain how far external conditions may influence the development of the shell in embryo, I have retained the species.

The shell represented in Mr. Dixon's work, t. 7, fig. 37, does not, in my opinion, belong to this species; for the pullus, though small, is obtuse, not conical and pointed; and the notch is very deep: it is, I think, a large specimen of *V. uniplicata.*

*Size.*—Axis, 3 inches nearly; diameter, 9-10ths of an inch.

*Localities.*—Bracklesham Bay. *French:* Rétheuil, Soissons, Cuise-Lamotte, (fide Desh.)

### No. 109. VOLUTA COSTATA. *Solander.* Tab. XXII, figs. 5 *a—d.*

VOLUTA COSTATA, *Soland.* 1766. Brand. Foss. Hant., p. 24; t. 3, fig. 45.
— — *Sow.* 1821. Min. Con., vol. iii, p. 163; t. 290, figs. 1 (non figs. 2 and 4).
Nec — — *Grat.* 1847. Conchyl. foss., &c. de l'Adour; Supp. t. 1, fig. 14*a*—*b*.
nec — — *Sow.* 1850. Dixon's Geol. &c., of Suss., p. 107; t. 5, fig. 24.

*V. testá ovato-fusiformi, costatá, lineis transversis ornatá; spirá elevatá, conicá; apice acuto: anfractibus convexiusculis; costis angustis inermibus; aperturá oblongo-ovali, ad basin sub-profunde emarginatá; labro simplici, tenui; labio angusto; columellá sub-rectá, quadri-plicatá.*

Shell ovately fusiform, longitudinally ribbed and ornamented with numerous transverse raised lines; spire conical, elevated, being as long or nearly as long as the aperture, and terminating in a small pointed pullus; whorls six or seven, exclusive of the pullus, and rather convex; the ribs simple, narrow, sharp, slightly curved and extending to the base, numerous on the early whorls, but becoming more distant as the shell is enlarged. The transverse lines, which are decussated by the lines of growth, are very slender, and irregular; every third or fourth line being thicker and more elevated than the others, except towards the base, where the more prominent lines are placed nearer to each other, and the intermediate ones become very faint or altogether obsolete.—Aperture of an oblong-oval form, rather deeply notched in front; outer lip simple, sharp-edged and smooth within; inner lip very narrow, and thin; columella nearly straight, and furnished with two oblique folds in front, and two or three slender, obscure ones behind.

Brander's specimen in the British Museum, is unfortunately mislaid, and I have not been able to refer to it; but, judging from the description and figure given in his '*Fossilia Hantoniensia*,' the present Volute must be the true *V. costata* of Solander; for the word *inermis*, used by that naturalist in his description, cannot be applied to the shells, distinguished by the thick nodiform terminations of their ribs, which have been referred by Mr. Sowerby to that species.

D'Orbigny (Prod. de Paléont., vol. ii, p. 352, No. 267) has recorded this Volute as identical with the *Cochlea mixta* of Chemnitz, (*V. costaria*, Lamk.); but in that species the shell is longer and narrower, the surface quite smooth, except at the base; and the columella curved and furnished with two folds only. The two shells appear to me to be quite distinct from each other.

The shell from Bracklesham Bay figured in Mr. Dixon's work (t. 5, fig. 24) as *V. costata*, is a specimen of *V. Maga;* and those from Dax and Saubrigues, which Grateloup has considered to be identical with Solander's shell (fig. 45) appear to belong to a different species; they are represented as sub-turreted, with numerous rounded ribs, and with many folds on the columella, extending nearly to the posterior extremity of the aperture.

*Size.*—Axis, 2 inches nearly; diameter, 8-10ths of an inch nearly.

*Locality.*—Barton.

### No. 110. VOLUTA HUMEROSA. *F. E. Edwards.* Tab. XXII, figs. 6 *a*, *b*.

VOLUTA COSTATA. *Sow.* 1821. Min. Con., vol. iii, p. 163; t. 290, figs. 2 and 4 (non fig. 1.)

*Testâ ovato-fusiformi, sub-turritâ, costatâ, transversim tenuissime lineatâ, ad basin profunde et late emarginatâ; spirâ productâ, apice acuto: anfractibus sub-planis; costis distantibus, crassis, rotundatis, postice nodigeris; aperturâ ovato-rhomboidali, postice sub-canaliculatâ; labro incrassato, intus lævi; labio angusto, crasso; columellâ flexuosâ, bis vel ter plicatâ.*

Shell ovately fusiform, sub-turreted, longitudinally ribbed, transversely finely striated; the base deeply and widely notched, and much bent backwards; spire elevated, but shorter than the last whorl; apex small, pointed: whorls five or six, exclusive of the embryonic whorls, very slightly convex, and flattened at the sides; ribs distant, broad, obtuse, reaching almost to the base, and at the posterior extremities swelling into large, rounded tubercles. Aperture ovately rhomboidal, terminating behind in a narrow, but conspicuous, channel; outer lip smooth within, thickened towards the suture, otherwise thin and sharp-edged; inner lip narrow, thick, particularly at the posterior extremity, where it forms almost a callus; columella curved, and furnished with two prominent folds in front, and sometimes a third faint one behind.

The Volutes which I propose to separate under the present specific name, have been confounded hitherto with the preceding species (*V. costata*, Sol.); they appear, however, to be specifically distinct. The shells are broad, obtusely angulated at the shoulders, with flattened sides; the ribs are more distant, thicker, and rounder, and on the last two whorls rise at the shoulder into large tubercles; the transverse lineation is more regular, and the aperture wider, and not contracted behind; the inner lip is much thicker, the columella more curved, and furnished with two folds, or, occasionally only, with a third faint one behind; and the base is much more bent backwards, owing to the deeper anterior notch. Specimens occasionally occur in which, owing to the tubercles being less prominent than usual, the spire is more regular in form, and the shells present a general resemblance to *V. costata;* but the whorls still preserve the flatness of the sides, and the ribs their characteristic roundness; and the condition of the columella and the inner lip show, in fact, that the individuals in question are merely a variety of the present species.

*Size.*—Axis, 2 inches and 2-10ths; diameter, 1 inch and 1-10th nearly.

*Localities.*—Barton, and Bracklesham Bay.

*Section A.* (*Pullus small, conical.*
*b. Shell fusiform; costated, transversely striated; inner lip narrow*) } *continued.*
*β. Columellar plaits numerous.*

### No. 111. Voluta Maga. *F. E. Edwards.* Tab. XXII, figs. 2 *a—f*.

Voluta magorum. *Sow.* 1821. Min. Con., vol. iii, p. 164; t. 290, fig. 3.
— — *Morris.* 1843. Cat. Brit. Foss., p. 168.
— harpula. *Sow.* 1840. Min. Con., vol. vii, p. 7; t. 614, fig. 1.
— — *Morris.* 1843. Cat. Brit. Foss., p. 167.
— costata. *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 107, t. 5, fig. 24.
— magnorum (ex errore). *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 353, No. 281.
— decora? *Beyr.* 1853. Die conchyl. des Norddeut. tertiarg. vol. i, p. 73; t. 4, figs. 5 *a—b*.
Nec. — magorum. *Brocc.* 1814. Conchol. foss., Subapen., vol. ii, p. 307; t. 4, fig. 2.
nec. — harpula. *Lamk.* 1802. Ann. du Mus., vol. i, p. 478, No. 9, and vol. xvii, p. 78, No. 13.

*V. testâ ovato-fusiformi, unduloso-costatâ, inermi, transversim tenuissime striatâ, ad basin profunde emarginatâ; spirâ obtusâ; apice sub-acuto; anfractibus sex vel septem,* *depresso-convexis: apertura oblongo-ovali, antice effusá; labro ad marginem tenui, acuto, intús incrassato; labio angustissimo, crasso; columellá leviter arcuatá, pluries plicatá, plicá penultimá majori.*

Shell ovately fusiform, ribbed, transversely furrowed, deeply notched, and bent backwards at the base; spire elevated, obtuse, with a small conical pullus; whorls six or seven, exclusive of the embryonic shell, convex, flattened at the sides, and separated by a deep suture. Ribs numerous, thick, rounded, slightly waved, and prolonged to the base; transverse furrows shallow, irregular, becoming faint, frequently almost obsolete, over the middle of the whorl. Aperture of an oblong-oval shape, wide in front, narrowing behind; outer lip simple, sharp-edged, and thickened within; inner lip very narrow, thick; columella slightly curved and furnished with ten or twelve folds, of which the front one is very oblique and moderately prominent, and the last but one larger and more transverse; the others rise almost to the suture, becoming feebler and more transverse as they ascend the columella. The ridge or crest on the columella, found in all the deeply notched species, is half concealed by the thick inner lip, but bulges out beyond the contour of the whorl.

The specimen of *V. magorum* figured by Brocchi was imperfect, and his description is short and unsatisfactory; it is, therefore, difficult to decide whether the shells described by Mr. Sowerby have been correctly referred by him to the Subapennine species. Judging, however, from Brocchi's figure and description, the *V. magorum* appears to be a more regularly convex shell, attenuated more equally at the extremities, and to have a more conical spire than the English shells. It is stated, also, to be smooth; but much reliance cannot be placed on this character, for Brocchi describes the shell as *convertita in ispato,* and the transverse furrows may have become obliterated in that process. The ribs are more numerous, and are slender and straight; the columellar folds also are more oblique, and the three front ones are nearly equal. The aperture appears to have been but slightly notched in front, inasmuch as the uninterrupted contour of the body whorl does not present the ridge caused by the retroflexion of the base, which always accompanies a deep notch. These distinctions, I think, show that the English shells, although closely allied to, are yet distinct from, Brocchi's species, or at all events that they cannot be safely considered as belonging to it.

The shells (figs. 2 *a, b*) referred by Mr. Sowerby to *V. harpula* (Lamk.), are only young shells of the present species, and are distinguished from the French species as well by the transverse striation as by the shorter and more obtuse spire, the more distant, thicker, and rounded ribs, the thinner outer lip, and the greater obliquity of the columellar folds.

Dr. Beyrich (*loc. cit.*) has described a Volute from Westeregeln (*Voluta decora*) which resembles the present species so closely that it is difficult to separate the two. The chief differences appear to be that the transverse striation is perceptible on the spire only, just below the suture, and on the front half of the body whorl; the whorls, although described as "almost flat," appear from the figure to be roundedly convex, and to be contracted towards the base, the columella is without the ridge, the presence of which evidences a deep notch, and the columellar folds appear to be nearly equal in size. In all other respects the two species agree. As to the transverse striation, that character becomes feeble on the last whorl of some of the English shells, and the absence of it in the only specimen of *V. decora,* possessed by Dr. Beyrich, and from which his description is taken, may be due to an imperfect preservation of the surface; the only difference, in fact, of specific value, is the character of the notch. Dr. Beyrich himself expresses great doubt whether the *V. magorum* of Sowerby is the same as his shell, and, without an actual comparison of the shells, I cannot venture to affirm their identity. If they should prove to belong to the same species, the name *V. decora* imposed by Dr. Beyrich will supersede the one I have given.

Individuals of the present species occur, although very rarely, at Bracklesham Bay, and usually retain traces of their ornamental colouring, consisting of numerous dark brown transverse bands, which I have not found in specimens from other localities.

*Size.*—Axis, 2 inches and 3-10ths; diameter, 1 inch.

*Localities.*—Barton, Highcliff, Alum Bay (Strat. No. 29, Prestw.), Bracklesham Bay. *German:* Westeregeln in Magdeburgh (fide Beyrich)?

### No. 112. VOLUTA BRANDERI. *Deshayes.* Tab. XXII, figs. 4 *a, b.*

VOLUTA BRANDERI. *Desh.* 1824—37. Descr. des Coq. foss., &c., vol. ii, p. 701; t. 90, figs. 15—16.
— — *Defr.* 1829. Dict. des Sci. nat., vol. lviii, p. 477.

*V. testâ ovato-oblongâ, turritâ, longitudinaliter costatâ, cæterum lævi; spirâ mediocri, acuminatâ, apice acuto: anfractibus convexiusculis; costis crassis, rotundatis: aperturâ elongatâ, angustâ, ad basin profunde emarginatâ; labro incrassato, simplici; labio angusto; columellâ triplicatâ et rugis transversalibus instructâ.*

Shell oval-oblong, turreted, longitudinally ribbed, otherwise smooth; spire moderately elevated, and terminating in a small, conical pullus: whorls six or seven, slightly convex; ribs rather numerous, thick, round, extending in front almost to the base, and prolonged backwards to the very edge of the whorl, where they terminate abruptly, forming, with their truncated extremities, a flattened ledge, which gives a turreted aspect to the spire. The only specimen I possess consists of the spire, the front part of the shell being broken away; but in the French shells the whorls are traversed at the base by several undulating striæ; the aperture is of a lengthened oval shape, deeply notched in front; the outer lip is much thickened, and smooth within; the inner lip is narrow, and the columella presents three moderately oblique folds in front, of which the middle one is the largest and most prominent, and several transverse raised lines behind. Fig. 4 *b*, taken from a French specimen, is introduced for comparison, and to shew the perfect shell.

In general appearance, this Volute resembles *V. maga;* but it is quite smooth excepting where a few faint lines traverse the base; the spire is turreted, more slender, and tapering; and the ribs more numerous and more prominent.

Mr. Sowerby has described* a Volute from the tertiary formation in Cutch (*V. dentata*), which somewhat resembles the present species; but the ribs terminate posteriorly in erect, pointed tubercles, the surface of the shell is concentrically striated, the outer lip is plicated within, and the columella presents only two, nearly equal, prominent folds.

*Size.*—According to M. Deshayes, axis, 1 inch and a half; diameter, three-quarters of an inch.

*Localities.*—Bracklesham Bay. *French:* Monneville, Valmondois (fide Desh.); Les Clergis, Acy (fide D'Orb.).

### No. 113. VOLUTA PROTENSA. *Sowerby.* Tab. XXIII, figs. 5 *a—c.*

VOLUTA PROTENSA. *Sow.* 1840. Min. Con., vol. vii, p. 5; t. 612, figs. 6, 7.

*V. testâ fusiformi, protensâ, transversim striatâ, in juventâ obscure costatâ; spirâ acuminatâ, apice acuto: anfractibus convexiusculis, ad margines suturales depressis: aperturâ angustâ, profunde emarginatâ; labro simplici, tenui, acuto; labio angusto; columellâ pluries plicatâ.*

Shell fusiform, elongated, transversely striated, obscurely ribbed in the young state; spire elevated, being as long as the aperture, and terminating in a small, pointed apex: whorls six or seven, rather convex, depressed round the sutural margin, and having the edge pressed against the spire: aperture narrow, deeply notched at the base; outer lip simple, thin, and sharp-edged; inner lip very narrow; columella straight, furnished with six or seven distant oblique folds ascending to the top of the columella; the fold in front is the largest and most prominent, the others thread like, and nearly equal.

This appears to be a well-marked species, quite distinct from all the other Eocene Volutes.

*Size.*—Axis, 2 inches; diameter, 6-10ths of an inch.

*Localities.*—Chalk Farm, Whetstone, Potter's Bar.

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* Grant's Geology of Cutch, Geol. Trans., 2d series, vol. v, p. 322; t. 25, fig. 26.

*Section B. Pullus sub-papillary.*

*a. Shell pyriform; inner lip effuse; columella plaits few.*

### No. 114. VOLUTA CITHARA. *Lamarck.* Tab. XXIII, figs. 6 *a—c.*

*Henckel.* 1760. Pyrotol., t. 5, fig. 9.
*Favanne.* 1780. D'Argenv. Conchyl. (3d edit.), t. 166, fig. 4.
*Burtin.* 1784. Oryctogr. de Bruxelles, t. 15, D.
CITHARŒDUS. *Chemn.* 1795. Conchy. cab., vol. xi, t. 212, figs. 2098, 2099.
VOLUTA HARPA. *Lamk.* (non LINN). 1802. Ann. du Mus., vol. i, p. 476, No. 1; and vol. xvii, p. 74, No. 1.
— CITHARA. — 1816. Tab. Encyclop. et méthod., t. 324, figs. 1 *a*, *b*.
— — — 1822. Hist. nat., &c., vol. vii, p. 346, No. 1.
— — *De France.* 1829. Dict. des Sci. nat., vol. lviii, p. 474.
— HARPA. *Desh.* 1833. Encycl. méthod. (Vers), vol. iii, p. 1143, No. 21.
— CITHARA. *Desh.* 1824—37. Descr. des Coq. foss., &c, vol. ii, p. 681; t. 90, figs. 11, 12.
— — *Sow.* 1842. Min. Con., vol. vii, p. 31; t. 625, figs. 1—3.
— — *Nyst.* 1843. Desc. des Coq., &c., de la Belg., 590, No. 508.
— — *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 106; t. 5, fig. 17.
— CYTHARA. *D'Orb.* 1850. Prod. de Paléont, vol. ii, p. 353, No. 277.

*V. testá ovato-oblongá, costatá, postice lævi, antice coarctatá, transversim sulcatá, late emarginatá; spirá brevi, sub-muricatá, apice sub-papillari: anfractibus convexis, ventricosis; costis distantibus, postice bispinosis: labro tenui, lævi; labio antice expanso; columellá quinquies plicatá.*

*Var.* ANGULATA (fig. 6 *b*) *testá breviori, latiori, costis numerosioribus; anfractibus angulatis, unicá serie spinarum coronatis.*

Shell ovate-oblong ventricose, contracted in front, ribbed, smooth except towards the base, where it is transversely furrowed; spire short, armed with short spines; apex conical, sub-papillary: whorls convex, rounded at the shoulder; ribs distant, extending to the middle of the whorls, crowned with two or three rather blunt, nodiform spines, which are lost on the last whorl of the fully formed shell. The aperture is effuse, and widely notched in front; the right lip is thin, sharp-edged, smooth within; the columellar lip thin, widely spread over the front part of the body whorl; columella furnished with one prominent very oblique fold in front, and three or four smaller ones behind.

The English specimens agree perfectly with the French shells, and the examination of a longer series of specimens than that to which Mr. Sowerby had access, shows that individuals occur here, as well as in France, having the spire considerably produced (fig. 6 *a*).

A short variety, (fig. 6 *b*), is also found, in which the whorls are angulated at the shoulder, the ribs are shorter, more numerous, and crowned with single, sharp, erect spines.

*Size.*—Axis 4 inches; diameter, 2¼ inches.

*Localities.*—Bracklesham Bay. *French:* Grignon, Courtagnon, Parnes (fide Desh.), Hattencourt, Hermes (fide D'Orb.). *Belgian:* Brussels, Panisel, near Mons (fide Nyst).

*Section B.* (*Pullus sub-papillary*) *continued.*

*b. Shell fusiform; inner lip narrow; columellar plaits few.*

### No. 115. VOLUTA UNIPLICATA. *Sowerby.* Tab. XXIII, figs. 2 *a—c*.

VOLUTA UNIPLICATA. *Sow.* 1850. Dixon's Geol., &c., of Suss., pp. 107 and 188, t. 7, figs. 45, 46.
— ANGUSTA. *Sow.* 1850. Idem., t. 7, fig. 37.

*V. testâ fusiformi, obsolete costatâ, in juventâ transversim tenuissime striatâ, ad basin obscure sulcatâ, profunde emarginatâ; spirâ conicâ, apice sub-papillari; anfractibus depresso-convexiusculis, obtuse angulatis; aperturâ oblongo-ovali; labro incrassato, intus lævi; labio angusto, crasso; columellâ leviter arcuatâ, uniplicatâ.*

Shell fusiform, faintly ribbed, obscurely sulcated towards the base, and deeply notched in front; spire elongated and nearly conical; pullus sub-papillary: whorls rather convex, flattened at the side, and obscurely angulated at the shoulder; in the young state they are ornamented with crowded, very fine, transverse striæ. The ribs are prominent, thick, rounded, and produced nearly to the base; but on the last two or three whorls they become obsolete, and are replaced by a row of obscure, blunt tubercles placed on the angle of the shoulder; the transverse striation is also lost, and the body whorl is smooth, except where the shallow, faint, basal furrows appear; the aperture is of a lengthened oval shape; the outer lip thickened near the suture, rather sharp-edged towards the front, and smooth within; the inner lip narrow and thick; the columella slightly curved, and furnished with one prominent fold, placed nearer to the anterior extremity than is usually the case.

Fig. 2 *a* is taken from the shell figured in Mr. Dixon's work (t. 7, fig. 37) as *V. angusta*.

This species, which appears to be well characterised, is not uncommon.

*Size.*—Axis, 3 inches nearly; diameter, 9-10ths of an inch.

*Locality.*—Bracklesham Bay.

No. 116. VOLUTA MURICINA. *Lamarck.* Tab. XXIII, figs. 1 *a—c.*

*Lister.* 1685. Hist. Conchyl., t. 1033, fig. 6?
*Favanne.* 1780. D'Argenv. Conchyl. (3d edit.), t. 66, fig. 1.
COCHLEA MIXTA? *Chemn.* 1795. Conchyl. cab., vol. xi, t. 212, figs. 3010—3011.
VOLUTA MURICINA. *Lamk.* 1816. Tableau Encyclop. et méth., t. 383, fig. 1 *a—b.*
— — — 1802. Ann. du Mus., vol. i, p. 477, No. 4; vol. xvii, p. 75, No. 5.
— — — 1822. Hist. nat., &c., vol. vii, p. 350, No. 5.
— — *Defr.* 1829. Dict. des Sci. nat., vol. lviii, p. 475.
— — *Desh.* 1833. Encyl. méth. (Vers), vol. iii, p. 1144, No. 24.
— — — 1824—37. Descr. des Coq. foss., &c., vol. ii, p. 697; t. 91, figs. 18—19; t. 93, figs. 3—4; t. 94, figs. 3—4.
— — *Sow.* 1844. Min. Con., vol. vii, p. 31; t. 626, figs. 4—6.
— — — 1850. Dixon's Geol., &c., of Suss., p. 107; t. 5, fig. 20.

*V. testâ ovato-fusiformi, ad basin sub-productâ, late emarginatâ, antice lævi, postice longitudinaliter tuberculato-costatâ; spirâ elongatâ, apice obtuso: anfractibus angulatis, in juventâ tenuissime transversim striatis, ultimo anfractu spiram in longitudine vix superanti: aperturâ oblongo-ovatâ; labro simplici; labio angusto; columellâ ter vel quater plicatâ, inter plicas anteriores sulco lato exaratâ.*

Shell ovately fusiform, produced, and widely, but not deeply, notched at the base; spire long and pointed, with a sub-papillary apex; whorls six or seven, obscurely furrowed at the base, smooth elsewhere, wide and angulated at the shoulder, crowned with a single row of pointed, pyramidal tubercles, having their bases prolonged into obtuse ribs, which are lost about the middle of the whorl; the last whorl is conical, and rather longer than the spire. In the immature shell the whorls are ornamented with numerous, very slender, transverse striæ, which are lost as the shell approaches maturity. The aperture is of an oblong oval shape; outer lip rather thick, with a blunt margin; inner lip narrow, thickened; columella round, curved, furnished with one large, prominent fold in front, and two or three smaller folds behind, and deeply furrowed between the two front folds.

The ribs sometimes, particularly in young specimens, extend far down the whorl, almost to the base, and the tubercles are rounded: specimens also occur which are narrower, and more slender than the typical form; and, again, others are found wider and shorter, according to the condition of the ribs. Indeed, as both M. Deshayes and Mr. Sowerby have remarked, the shell is so variable in this respect, as to render it difficult to define. The transverse striation is found as well on the French as on the English shells, although that character is not noticed either by Lamarck or Deshayes.

*Size.*—Axis, 3 inches and 4-10ths; diameter, 1 inch and 6-10ths.

*Localities.*—Bracklesham Bay. *French:* Grignon, Parnes, Mouchy, Courtagnon (fide Desh.), Chaumont (fide D'Orb.).

*Section C. Pullus papillary.*

*a. Shell fusiform; inner lip effuse; columella plaits few.*

### No. 117. VOLUTA WETHERELLII. *Sowerby.* Tab. XXIII, figs. 4 *a—d.*

VOLUTA WETHERELLII. *Sow.* 1836. Lond. and Edinb. Phil. Mag., and Journ. of Science, 3d ser., vol. ix, p. 463, note.
— — *Sow.* 1840. Min. Con., vol. vii, p. 5; t. 612, figs. 1—5.

*V. testá fusiformi, elongatá, ad basin parum emarginatá? in juventá concentrice lineatá, deinde lævi; lineis confertis, subtilissimis; spirá conicá, apice papillari: anfractibus sex vel septem, convexis, marginibus ad spiram adpressis: aperturá elongato-ovali; columellá subrectá, triplicatá; labro ?; labio effuso.*

Shell fusiform, elongated, slightly produced in front; spire conical, elevated, and terminating in an obtuse papillary apex: whorls six or seven, convex, with the margins pressed against the preceding volutions, and presenting a broad, shallow depression, which runs round the spire between the shoulder and the suture. The earlier whorls are ornamented with numerous concentric raised lines; these lines are much crowded, and so very fine as to be scarcely visible by the naked eye, and do not detract from the apparently even surface; the last whorl is smooth. Aperture of a lengthened oval form, columella nearly straight, and furnished at maturity with moderately oblique folds, of which the one in front is the smallest, and that in the middle the largest; inner lip widely spread over the body-whorl, but not extending backwards beyond the suture; the base, apparently, but slightly notched, as the columella does not present any prominent ridge. The outer lip is not preserved in any specimen I have seen.

This Volute presents a remarkably close analogy with the well-known Crag species *V. Lamberti;* but it is a longer, narrower shell, with a much smaller pullus; and the columella presents three unequal folds instead of the four nearly equal folds which characterise that species. It appears to be confined to the lower formations in the neighbourhood of London, and has not as yet been found, I believe, at Highgate.

*Size.*—The actual dimensions cannot be stated accurately; those of the largest of the specimens figured must have been, axis, 5 inches, nearly; diameter, 1 inch and 8-10ths, nearly.

*Localities.*—Camden Town, Chalk Farm, Haverstock Hill, Hornsey, Copenhagen Fields, Holloway, Whetstone, Potter's Bar, Bayswater, Brentford, Sheppey.

## Genus 24th. MITRA.* *Lamarck.* 1801.

MITRA, TURRIS, *Montf.*, 1810.
CYLINDRA, IMBRICARIA, *Schum.*, 1817.
TIARA, MITREOLA, CONŒLIX, MITRELLA, *Swains.*, 1840.
VULPECULA, *Gray*, 1840.

*Gen. Char.*—Shell fusiform, smooth, longitudinally ribbed or cancellated; spire elevated, pointed: aperture longitudinal, narrow, notched at the base, and without a canal, or at most with a very short one; outer lip sometimes thickened, generally sharp-edged, internally smooth or crenulate; columella plaited, folds regular, nearly transverse, the anterior one the smallest.

The Mitres are distinguished from the Volutes, with which they had been associated until they were separated by Lamarck, by their more elongated, less ventricose form, and by the character of the columellar plaits, which are more transverse and regular, with the smaller one in front, a disposition the reverse of that which characterises the Volutes.

The animal has a small, narrow head, with short, pointed tentacles, on the external sides or bases of which the eyes are placed; but some species from the Mediterranean, according to M. Deshayes, bear pedicels much shorter than the tentacles, united to them, and terminated by the ocular points. The foot is narrow, truncate in front, pointed behind; and the anterior margin of the mantle is produced into a short, cylindrical canal. But that which chiefly distinguishes the animal of *Mitra*, is the great length of the proboscis, which, in some species, considerably exceeds that of the shell.

The Mitres, as defined by Lamarck, have been subdivided into several genera, dependent chiefly on conchological distinctions. In some of these divisions the animals, according to observations recently made by Dr. Gray, exhibit modifications of the lingual teeth closely resembling those characteristic of other genera; and that eminent naturalist, therefore, regards the *Mitræ* as forming a family distinct from the *Volutidæ*, with which they have usually been associated. The small, narrow foot, and elongated proboscis lead, apparently, to the same conclusion.

The living *Mitræ* are very numerous; upwards of 350 species being known; of these one is from the coast of Greenland, and some few small species are found in the Mediterranean. With these exceptions, the *Mitræ* are confined to tropical or subtropical seas, where they are found, according to Messrs. Adams, chiefly on the shores of islands, but few species inhabiting continental shores. They appear to be deep-sea molluscs, most of the species ranging in depth from 15 to 80 fathoms, although some few are littoral.

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* Etym. Μιτρα, a turban or covering for the head, worn by the Persians and other Asiatics.

## TAB. XVI.

Fig.

1. Cypræa oviformis. No. 71*, *p.* 128.
   - *a.* Back view, adult shell from Primrose Hill.
   - *b.* Front view of the same.
   - *c.* Front view, adult shell from Highgate.
   - *d.* Front view, adult shell (globose var.) from Whetstone.
   - *e.* Back view, young shell (first stage) from Barnett.
   - *f.* Front view of the same.
   - *g.* Side view, (shell in second stage), from Potter's Bar.
   - *h.* Side view, adult shell, showing the inner whorls.
   - *i.* Original specimen from the well on Hampstead Heath, described as ***Ovulum retusum.***

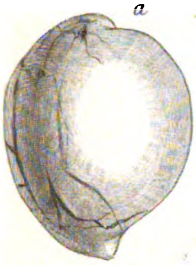
2. Cypræa tuberculosa (Var. *Coombii*). No. 75, *p.* 131.
   Front view.

3. Cypræa globularis. No. 73, *p.* 130.
   - *a.* Back view.
   - *b.* Front view.

4. Cypræa inflata. No. 71, *p.* 126.
   - *a.* Back view.
   - *b.* Front view.

Tab. XVI.

1 a



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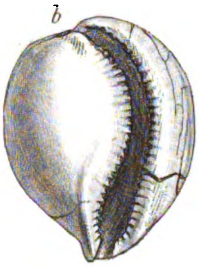

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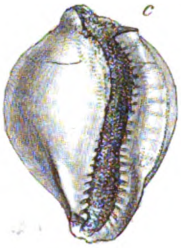

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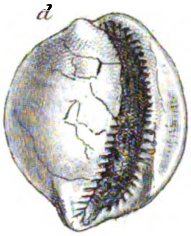

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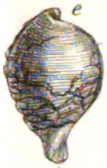

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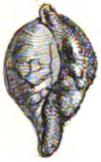

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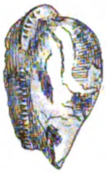

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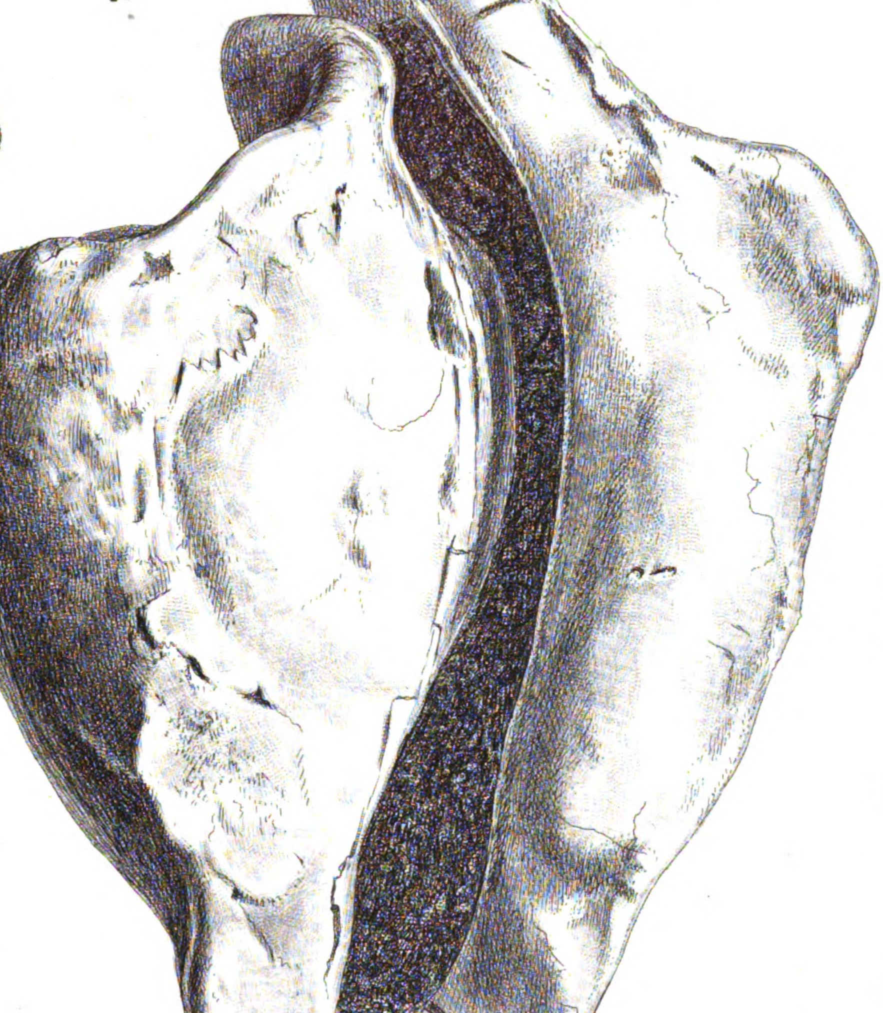

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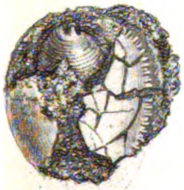

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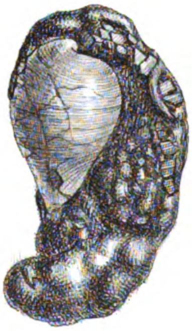

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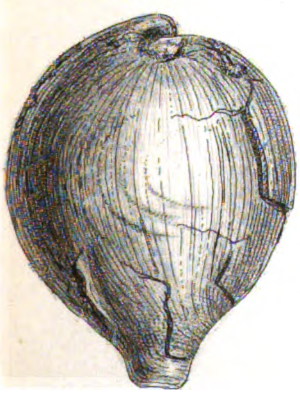

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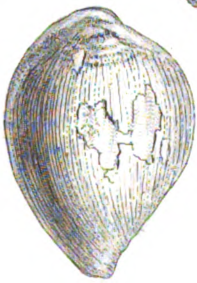

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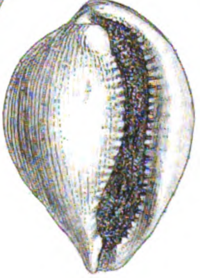
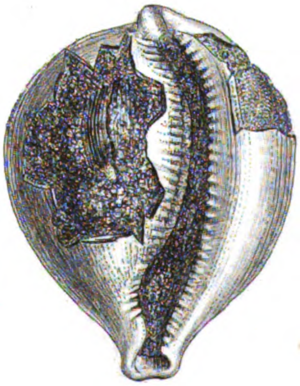


3. b



J. De C. Sowerby fecit.

## TAB. XVII.

Fig.

1. Cypræa Bowerbankii. No. 72, *p.* 129.
    - *a.* Back view, shell from Highgate.
    - *b.* Front view of the same.
    - *c.* Back view, shell from Bracklesham Bay.
    - *d.* Front view, ditto.

2. Cypræa Prestwichii. No. 78, p. 134.
    - *a.* Back view, natural size.
    - *b.* Back view of the same, magnified.
    - *c.* Front view of the same, ditto.

3. Ovula? antiqua. No. 79, *p.* 136.
    - *a.* Back view, natural size.
    - *b.* Back view of posterior extremity, magnified.

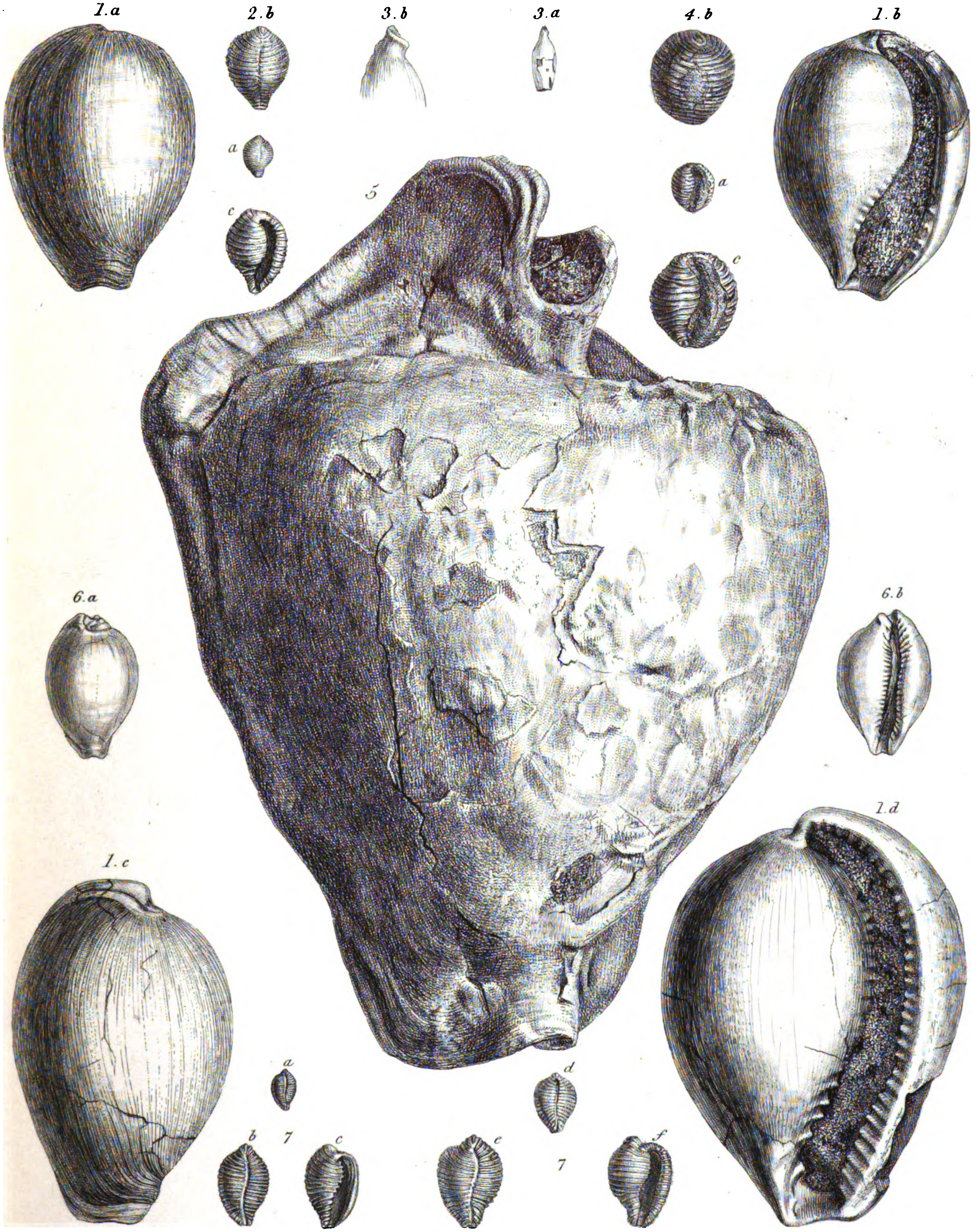
4. Cypræa Wetherellii. No. 77, *p.* 133.
    - *a.* Front view, natural size.
    - *b.* Back view of the same, magnified.
    - *c.* Front view of the same, ditto.

5. Cypræa tuberculosa, (Var. *Coombii*). No. 75, *p.* 131.
    Back view.

6. Cypræa Bartonensis. No. 74, *p.* 130.
    - *a.* Back view.
    - *b.* Front view.

7. Cypræa platystoma. No. 76, *p.* 132.
    - *a.* Back view of young shell, natural size.
    - *b.* Back view of the same, magnified.
    - *c.* Front view of the same, ditto.
    - *d.* Back view of adult shell, natural size.
    - *e.* Back view of the same, magnified.
    - *f.* Front view of the same, ditto.

Tab. XVII.



J. De C. Sowerby fecit.

## TAB. XVIII.

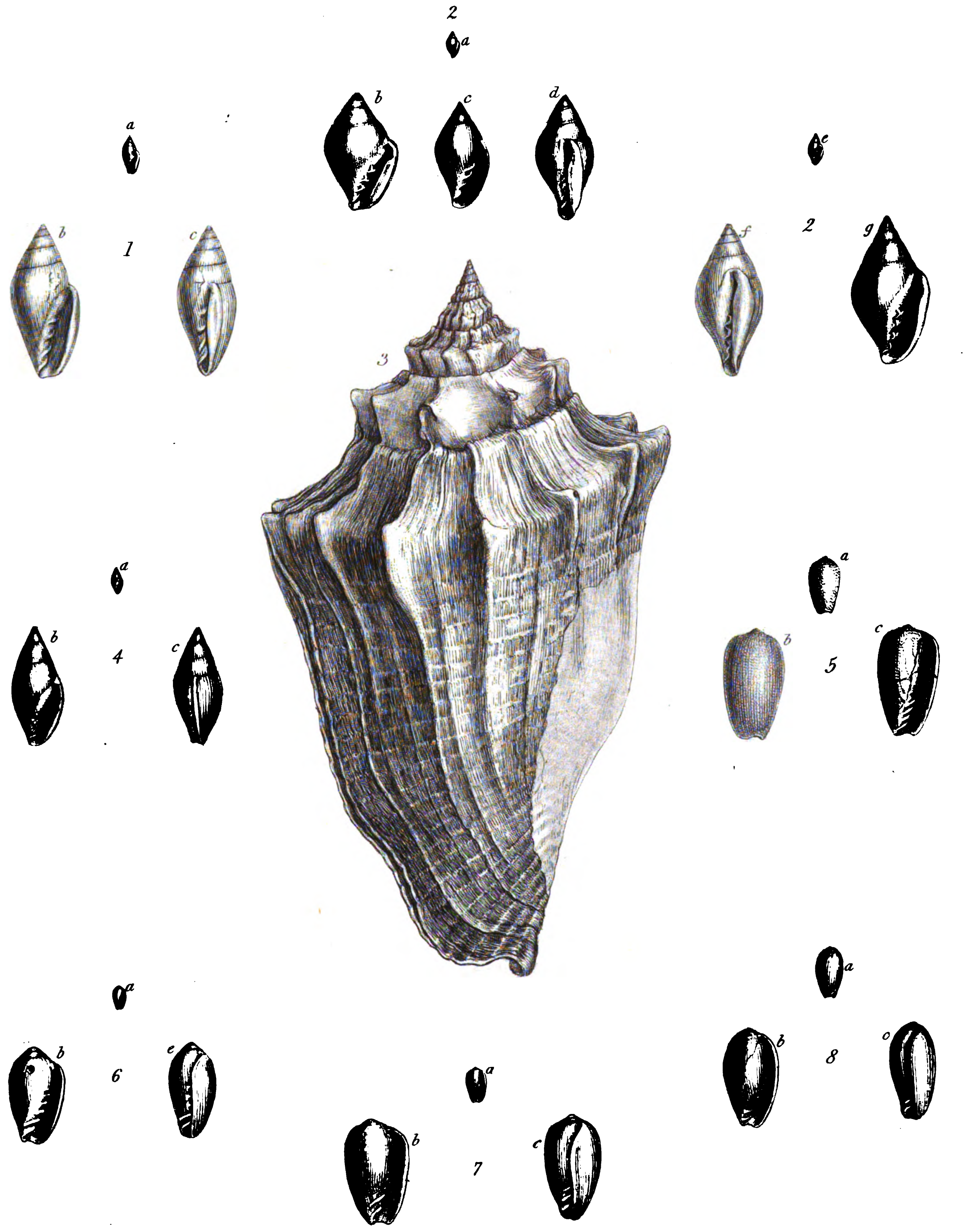
Fig.

1. Marginella eburnea. No. 80, *p.* 137.
    - *a.* Front view, natural size.
    - *b.* Front view, magnified.
    - *c.* Side view, ditto.
2. Marginella bifido-plicata. No. 81, *p.* 139.
    - *a.* Front view of adult shell from Barton, natural size.
    - *b.* Front view of the same, magnified.
    - *c.* Front view of young shell, from ditto, ditto.
    - *d.* Side view of adult shell, ditto, ditto.
    - *e.* Front view of adult shell, Var. from Alum Bay, nat. size.
    - *f.* Side view of the same, magnified.
    - *g.* Front view of the same, magnified.
3. Voluta luctatrix. No. 87, *p.* 147.
    - Back view, adult shell.
4. Marginella gracilis. No. 82, *p.* 140.
    - *a.* Front view, natural size.
    - *b.* Front view, magnified.
    - *c.* Side view, ditto.
5. Marginella ovulata. No. 83, *p.* 141.
    - *a.* Back view, natural size.
    - *b.* Back view, magnified.
    - *c.* Front view, ditto.

*Note.*—The posterior extremity of the outer lip is imperfect.

6. Marginella pusilla. No. 84, *p.* 143.
    - *a.* Front view, natural size.
    - *b.* Front view, magnified.
    - *c.* Side view, ditto.
7. Marginella vittata. No. 86, p. 144.
    - *a.* Front view, natural size.
    - *b.* Front view, magnified.
    - *c.* Side view, ditto.
8. Marginella simplex. No. 85, *p.* 143.
    - *a.* Back view, natural size.
    - *b.* Front view, magnified.
    - *c.* Side view, ditto.

Tab. XVIII



J. De C. Sowerby fecit.

## TAB. XIX.

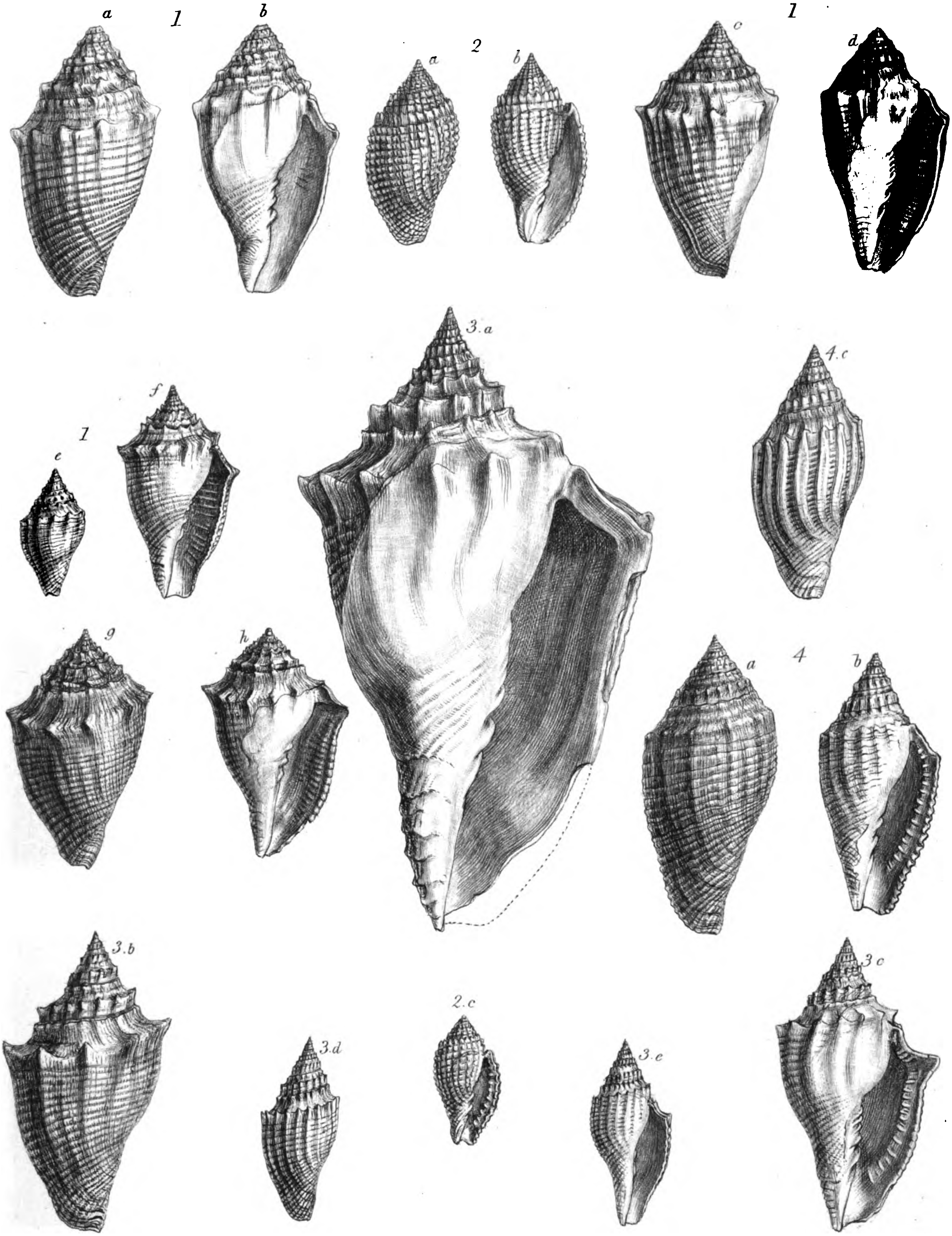
Fig.

1. Voluta nodosa. No. 88, *p.* 148.
    - *a.* Back view of adult shell from Barton.
    - *b.* Front view of the same.
    - *c.* Back view of adult shell from Highgate.
    - *d.* Front view of ditto, ditto.
    - *e.* Back view of young shell from Bracklesham Bay.
    - *f.* Front view of adult shell, ditto.
    - *g.* Back view of ditto, ditto.
    - *h.* Front view of ditto, ditto.

*Note.*—Portions of the inner lip in the specimens, figs. 1*a* and 1*h*, are broken off.

2. Voluta digitalina, (Var. *lima*). No. 90, *p.* 151.
    - *a.* Back view, adult shell.
    - *b.* Front view, ditto.
    - *c.* Front view, ditto, with outer lip thickened and plicated.
3. Voluta luctatrix. No. 87, *p.* 147.
    - *a.* Front view, adult shell.
    - *b.* Back view, shell of mid-growth.
    - *c.* Front view, ditto.
    - *d.* Back view, young shell.
    - *e.* Front view, ditto.
4. Voluta ambigua. No. 89, *p.* 150.
    - *a.* Back view, adult shell.
    - *b.* Front view of the same.
    - *c.* Back view, (Var. *compressa*).

Tab. XIX.



J. De C. Sowerby fecit.

# TAB. XX.

Fig.

1. Voluta crenulata. No. 92, *p.* 154.
   - *a.* Back view.
   - *b.* Front view.

2. Voluta elevata. No. 91, *p.* 153.
   - *a.* Back view, young shell.
   - *b.* Back view, adult shell.
   - *c.* Back view, adult shell from Southampton.
   - *d.* Front view of the same.

3. Voluta recticosta. No. 95, *p.* 157.

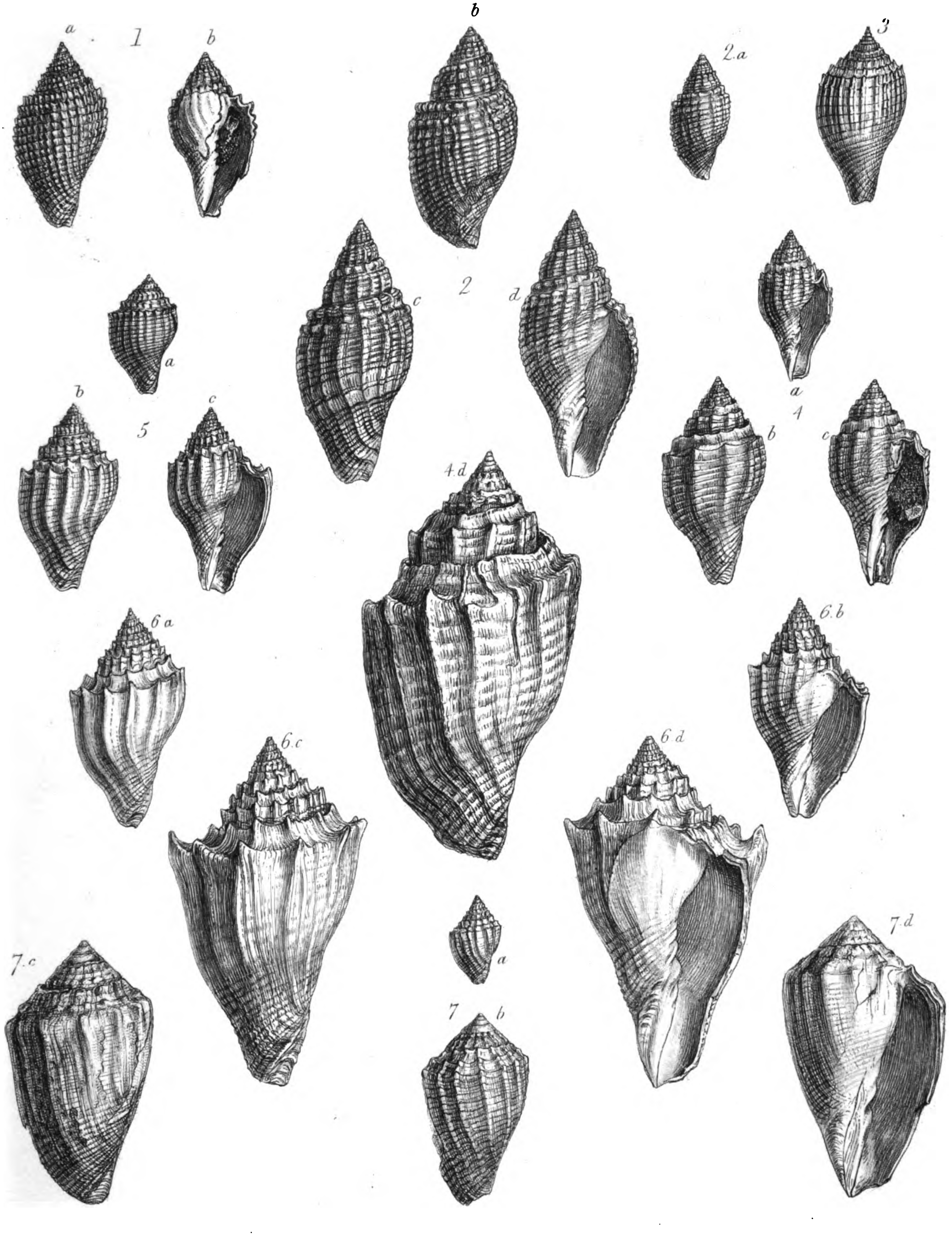
   Back view.

4. Voluta suspensa. No. 96, *p.* 158.
   - *a.* Front view, young shell.
   - *b.* Back view, shell of mid-growth.
   - *c.* Front view, ditto.
   - *d.* Back view, adult shell.

5. Voluta scalaris. No. 94, *p.* 156.
   - *a.* Back view, shell from Highcliff.
   - *b.* Back view, shell from Barton.
   - *c.* Front view, ditto.

6. Voluta Solandri. No. 93, *p.* 155.
   - *a.* Back view, shell of mid-growth.
   - *b.* Front view, ditto.
   - *c.* Back view, adult shell.
   - *d.* Front view, ditto.

7. Voluta tricorona. No. 97, *p.* 159.
   - *a.* Back view, young shell from Primrose Hill.
   - *b.* Back view, shell of mid-growth from ditto.
   - *c.* Back view, adult shell from Copenhagen Fields.
   - *d.* Front view, adult shell from Potter's Bar.



J. De C. Sowerby fecit.

## TAB. XXI.

Fig.

1. Voluta Forbesii. No. 105, *p.* 166.
    - *a.* Back view, young shell, natural size.
    - *b.* Back view, adult shell, ditto.
    - *c.* Front view of the same, magnified.
    - *d.* Back view, ditto, ditto.

2. Voluta horrida. No. 104, *p.* 166.
    - *a.* Back view, natural size.
    - *b.* Back view, magnified.
    - *c.* Ribs, magnified.

3. Voluta geminata. No. 103, *p.* 165.
    - *a.* Back view, adult shell.
    - *b.* Front view, ditto.

4. Voluta spinosa. No. 101, *p.* 162.
    - *a.* Back view.
    - *b.* Front view.

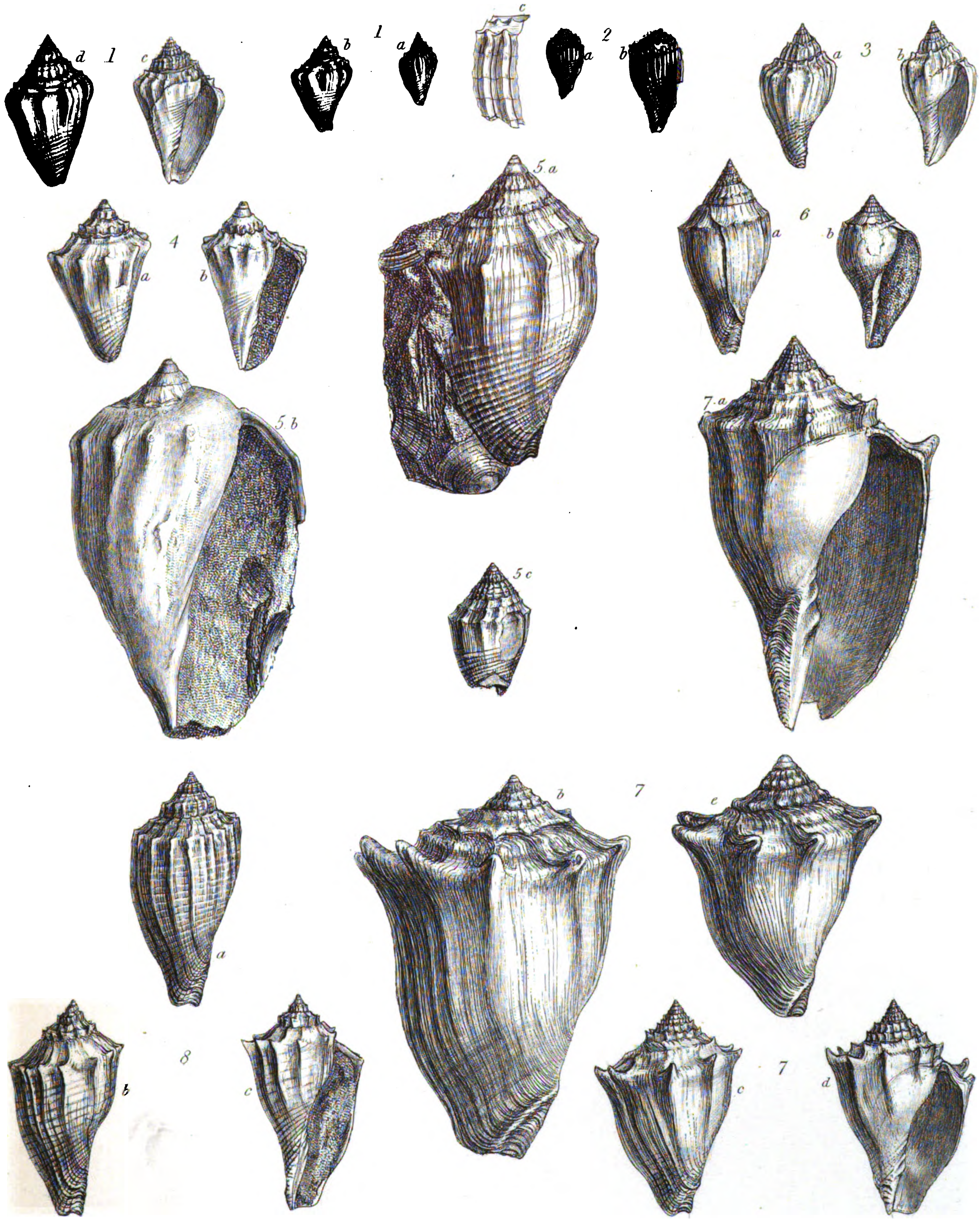
5. Voluta denudata. No. 100, *p.* 162.
    - *a.* Back view, shell of mid-growth.
    - *b.* Front view, adult shell.
    - *c.* Back view, young shell.

6. Voluta calva. No. 106, *p.* 167.
    - *a.* Back view, adult shell.
    - *b.* Front view, shell of mid-growth.

7. Voluta athleta. No. 99, *p.* 161.
    - *a.* Front view, adult shell from Barton.
    - *b.* Back view, ditto, ditto.
    - *c.* Back view, shell of mid-growth, ditto.
    - *d.* Front view of the same.
    - *e.* Back view (Var. *Fortis*), adult shell from Highcliff.

8. Voluta depauperata. No. 102, *p.* 164.
    - *a.* Back view, adult shell from Barton.
    - *b.* Back view, ditto from Colwell Bay.
    - *c.* Front view, ditto, ditto.

Tab. XXI.



J. De C. Sowerby fecit

## TAB. XXII.

Fig.

1. Voluta pugil. No. 98, *p.* 159.
    - *a.* Back view.
    - *b.* Front view.
    - *c.* Back view, (Var. *platyspina*).

2. Voluta maga. No. 111, *p.* 172.
    - *a.* Back view, young shell described in Min. Con., as to *V. harpula*.
    - *b.* Front view of the same.
    - *c.* Back view, young shell.
    - *d.* Front view, shell of mid-growth (*V. Magorum* of Sow.).
    - *e.* Front view, adult shell.
    - *f.* Back view of the same.

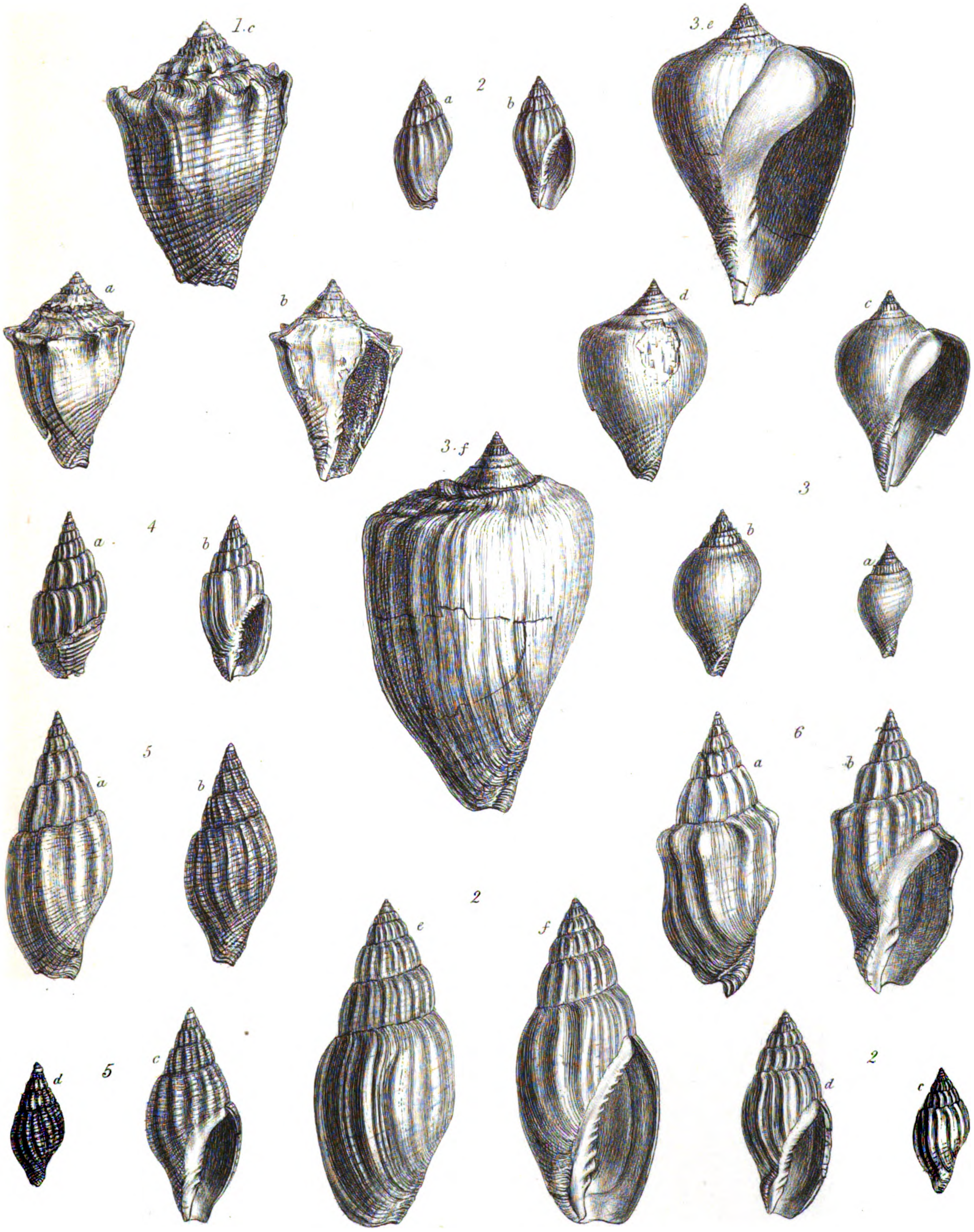
3. Voluta Selseiensis. No. 107, *p.* 168.
    - *a.* Back view, young shell (*V. bulbula* of Sow.).
    - *b.* Back view, ditto.
    - *c.* Front view, shell of mid-growth.
    - *d.* Back view of the same.
    - *e.* Front view, adult shell (*V. labrella* of Sow.).
    - *f.* Back view, ditto.

4. Voluta Branderi. No. 112, *p.* 174.
    - *a.* Back view, adult shell from Bracklesham Bay.
    - *b.* Front view, French specimen of mid-growth.

5. Voluta costata. No. 109, *p.* 170.
    - *a.* Back view, adult shell.
    - *b.* Back view, shell of mid-growth.
    - *c.* Front view of the same.
    - *d.* Back view, young shell.

6. Voluta humerosa. No. 110, *p.* 171.
    - *a.* Back view, adult shell.
    - *b.* Front view of the same.

Tab. XXII.



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# TAB. XXIII.

Fig.

1. Voluta muricina. No. 116, *p.* 178.
    - *a.* Back view, shell of mid-growth.
    - *b.* Side view.
    - *c.* Back view, adult shell

2. Voluta uniplicata. No. 115, *p.* 177.
    - *a.* Side view, adult shell.
    - *b.* Front view, shell of mid-growth.
    - *c.* Back view, ditto.

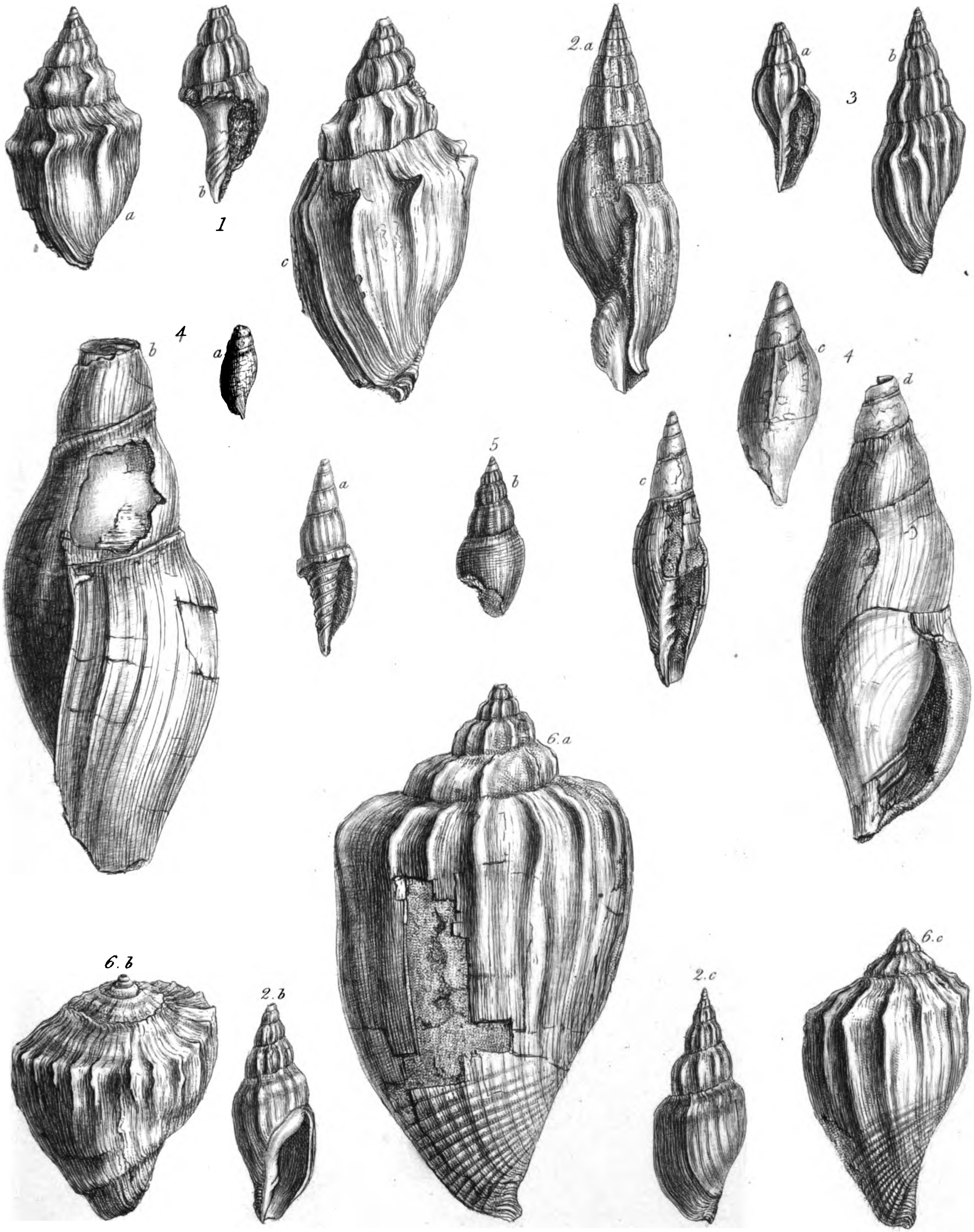
3. Voluta angusta. No. 108, *p.* 169.
    - *a.* Front view, young shell.
    - *b.* Back view, adult shell.

4. Voluta Wetherellii. No. 117, *p.* 179.
    - *a.* Back view, young shell with the pullus.
    - *b.* Side view, adult shell.
    - *c.* Back view, young shell.
    - *d.* Front view, adult shell.

5. Voluta protensa. No. 113, *p.* 175.
    - *a.* Side view, shell from Whetstone.
    - *b.* Back view, ditto.
    - *c.* Front view, adult shell from Potter's Bar.

6. Voluta cithara. No. 114, *p.* 176.
    - *a.* Back view, adult shell.
    - *b.* Back view, (Var. *angulata*).
    - *c.* Back view, shell of mid-growth.

Tab. XXIII.



J. De C. Sowerby fec.

THE

# PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.
184

LONDON:

MDCCCLVI.
1856

# A MONOGRAPH

OF

# THE EOCENE MOLLUSCA,

OR

## DESCRIPTIONS OF SHELLS FROM THE OLDER TERTIARIES OF ENGLAND.

BY

FREDERIC E. EDWARDS.

## PART III, No. II.

## PROSOBRANCHIATA

(CONTINUED).

LONDON:
PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.
1856.

J. E. ADLARD, PRINTER, BARTHOLOMEW CLOSE.

In a fossil state, the genus first appears in the cretaceous formations, in which five or six species are stated to occur; but during the tertiary epoch, the species became much more numerous. More than forty have been described from the eocene strata, and a still greater number from the more recent deposits. From the English eocene strata, four species have been noticed; of these, three, described by Mr. Sowerby in 'Mineral Conchology,' appear to be confined to this country; the fourth occurs at Bracklesham, and is identical with a species abundant in the Paris basin. Three additional species are now described for the first time.

No. 118. **Mitra scabra.** *Sowerby.* Tab. XXIV, fig. 6 *a—c.*

Small latticed Lymington whelk, *Pet.* 1764. Gazophyll., t. 73, fig. 9.
Buccinum scabriculum, *Soland.* (non *Gmel.*) 1766. Brand. Foss. Hant., p. 15, fig. 20.
Mitra scabra, *Sow.* 1823. Min. Con., vol. iv, p. 142, t. 401.
*Morris.* 1843. Cat. Brit. Foss., p. 151.

CORRIGENDUM.

Page 212, line 3 from the bottom, *add* "Nuneham" to the list of localities.

preceding whorls. The aperture is of a lengthened oval shape, narrowed posteriorly; the outer lip sharp and thin in the young shell, but irregularly thickened at maturity, and presenting an obscure, slender, raised border along the outer edge, and a blunt triangular tooth-like callus on the inner edge, near the posterior extremity; the columella is furnished with four distant, nearly transverse folds, of which the anterior one is much the smallest; and some specimens also present one or two obscure transverse lines towards the posterior part of the columella. The inner lip is very narrow, and much thickened where the folds are placed. Owing to the great depth of the notch, the base of the shell is more bent backwards than is usually the case in the fossil *Mitræ*, and presents the prominent crest or ridge which, as we have seen in the *Volutes*, always accompanies a deep notch.

In the general form of the shell, the condition of the apex and of the outer lip, the columellar plaits, and the deep anterior notch, this *Mitra* so much resembles *M. labratula*, that it might almost be regarded as merely a variety of that species in which the longitudinal ribs and transverse lines found in the young state have been continued on the mature shell. I have not, however, met with any smooth specimen of the present species, and mature individuals of *M. labratula* are, apparently, always smooth, with the exception of a few obscure transverse lines near the suture, or at the base. This want of intermediate forms, therefore, confirms the title of *M. scabra* to specific distinction.

*Size.*—Axis, 11-12ths of an inch; diameter, 5-12ths of an inch.

*Locality.*—The species appears to be confined to the Barton beds. I have not met with it elsewhere.

### No. 119. MITRA LABRATULA. *Lamarck.* Tab. XXIV, fig. 3 *a*, *b*.

MITRA LABRATULA, *Lamk.* 1803. Ann. du Mus., vol. ii, p. 58, No. 5, t. 3, fig. 6.
— LABRATELLA, *Ib.* 1816. Tab. Encycl. et Méthod., t. 392, fig. 3 *a*, *b*.
— LABRATULA, *Ib.* 1822. Hist. Nat., vol. vii, p. 325, No. 5.
— — *Defr.* 1824. Dict. des Sci. Nat., vol. xxxi, p. 491.
— — *Desh.* 1830. Encyc. Méthod. (vers.), vol. ii, p. 465, No. 42.
— — *Ib.* 1824—37. Descr. des Coq. Foss. &c., vol. ii, p. 672, t. 88, figs. 9, 10, 18 and 19.
— — *Mellev.* 1843. Mém. sur les Sables tert. inf., &c., de Paris, p. 17.
— — *Roissy.* . Buff. Moll., vol. v, p. 443.
— MONODONTA, *Sow.* (non *Lamk.*) 1850. Dix. Geol., &c., Suss., p. 106, t. 7, figs. 20, 21.
— LABRATULA, *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 354, No. 296.

*M. testâ ovato-acutâ, lævi, aliquando in juventâ costulis et striis transversis decussatâ, ad basin profunde emarginatâ: spirâ conicâ, apice obtuso: aperturâ elongatâ, angustâ; labro incrassato, sub-marginato, intûs unidentato; columellâ quadriplicatâ.*

Shell ovately oblong, slightly ventricose, smooth; sometimes in French specimens the early volutions present obscure undulating ribs, decussated by irregular, transverse, fine, raised lines, which altogether disappear on the last volution, or are reduced to a few faint lines, nearly obsolete, at the base, or round the sutural margin: the spire is conical with an apex formed, like that of *M. scabra*, of two roundish embryonal whorls, and, as in that species, the base is deeply notched, and bent backwards. The aperture is of a long, ovate shape, and rather narrow; the outer lip thickened, slightly bent outwards, so as to form a narrow, raised border along the outer margin, and furnished, generally, with a blunt, tooth-like callus on the inner edge, near the posterior extremity; the columella presents four prominent, almost transverse folds, the posterior three of which are nearly equal, and are larger than the one in front.

All the English specimens I have seen belong to the smooth variety, and do not present the longitudinal ribs and transverse lines which are sometimes found on the earlier whorls of the French shells, nor have I met with any specimen presenting the concentric striæ on the surface which characterise the variety from Courtagnon and the neighbourhood of Valognes.

I have already mentioned the strong resemblance between this species and *M. scabra;* in fact, with the exception of the scabrous aspect of the latter, it would be difficult to point out specific differences between the two.

M. Deshayes states that in some of the French specimens traces of the natural colouring remain, consisting of longitudinal iron-reddish coloured bands. The English specimens, imbedded in a less favorable matrix, do not present any traces of their original colouring.

*Size.*—Axis, 11-12ths of an inch; diameter, rather more than 5-12ths of an inch.

*Localities.*—Bracklesham Bay, where it is somewhat rare. *French:* Grignon, Parnes, Mouchy, Courtagnon, Chaumont, Valognes, St. Felix, Le Tomberay (fide *Desh.*), and Laon (fide *Mellev.*).

### No. 120. MITRA PARVA. *Sowerby.* Tab. XXIV, fig. 1 *a*—*c*, and 2 *a*—*c*.

MITRA PARVA, *Sow.* 1825. Min. Con., vol. v, p. 37, t. 430, fig. 1.
— PUMILA, *Ib.* 1825. Min. Con., vol. v, p. 37, t. 430, fig. 2.
— PARVA, *Ib.* 1850. Dixon's Geol., &c., of Sussex, p. 106.
— — *Morris.* 1843. Cat. of Brit. Foss., p. 151.
— PUMILA, *Ib.* 1843. Cat. of Brit. Foss., p. 151.
— PARVA. *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 355, No. 314.
— PUMILA. *Ib.* 1850. Prod. de Paléont., vol. ii, p. 355, No. 315.
— PARVA. *Morris.* 1854. Cat. of Brit. Foss., 2d edit., p. 258.
— PUMILA. *Ib.* 1854. Cat. of Brit. Foss., 2d edit., p. 258.

*M. testâ parvâ, ovato-fusiformi, sub-turritâ, concentrice sulcatâ, ad basin vix emarginatâ: spirâ elevatâ, acuminatâ: anfractibus convexis, uno sulco prope marginem suturalem circumdatis; suturis distinctis: aperturâ lanceolatâ: labro undato, acuto, intùs plicifero; columellâ quinquies plicatâ.*

*Var.* SEMILÆVIS. *Testâ anfractibus uno sulco prope marginem suturalem circumdatis; et ad basin obscure sulcatis, cæterum lævi; spirâ exsertiori.*

*Var.* PUMILA, fig. 2 *a*—*c*. *Testâ fasciolis elevatis concentricis et costellis longitudinalibus decussatâ.*

*Var.* β. *Testâ costellarum longitudinalium experti.*

Shell small, ovately fusiform, transversely furrowed, and but slightly notched at the base; spire elevated, pointed, and formed of seven or eight convex volutions, separated by a deep suture, and with the margins thickened and rather depressed, giving a sub-turreted character to the spire; the furrows are broad, round, and nearly regular; the posterior furrow is deeper than the others, and from this circumstance the margin of the whorls assumes the appearance of a rim. The aperture is narrow, and of a lengthened oval form; the outer lip waved, sharp-edged, and plicated within, at a short distance from the margin; the columella is nearly straight, and presents near the middle two rather prominent and nearly transverse folds, and in front of them three others more oblique, and of which the anterior one is much the smallest.

In the variety *semilævis,* the whorls are nearly smooth, presenting only the deep sulcus round the sutural margin, and a few obscure furrows, almost obliterated, near the base; and the spire is rather more elevated than in the type.

In the variety *pumila,* the surface of the whorls presents numerous longitudinal, irregular, slightly waved costellæ, not much elevated, but extending almost to the base, and crossed by concentric raised bands, which decussate them, and impart a rough aspect to the shell. The concentric bands are irregular, more or less numerous in different individuals, and rather flattened on the upper surface. When the costellæ are well defined, the concentric bands, at the points of decussation, rise into little tubercles; the marginal band, thus tuberculated, forms the crenulated edge to the whorls noticed by Mr. Sowerby; but this does not appear to be a constant character.

Occasionally specimens occur (*var.* β) in which the longitudinal costellæ are altogether wanting, and the whorls present only the concentric bands.

If we look only at the extreme forms figured in 'Mineral Conchology,' it need not excite surprise that Mr. Sowerby, who had not any intermediate forms before him, should have described the variety *pumila* as a distinct species. On an attentive examination, however, it will be seen that the distinction between that variety and the type lies in the character of the transverse marking, which in the type consists of shallow, rounded furrows; while in the variety it assumes the form of flattened bands. This difference, however, which is attributable to the greater or less depth of the furrows, cannot be regarded as of specific value; and the occurrence of ribless specimens with transverse bands, shows that the presence or absence of the costellæ is not a character on which reliance is to be placed.

The apex of the shell appears to have been very susceptible of erosion, for specimens with the embryonal whorls preserved are very rare.

*Size.*—Axis, rather more than 3-12ths of an inch; diameter, 2-12ths of an inch, nearly.

*Localities.*—For the type, Highcliff, where it is found in profusion, Barton, Alum Bay (No. 29, Prestw.), where the variety *semilævis* is abundant, and Brockenhurst; and for the variety *pumila,* Highgate, Basingstoke, Bracklesham Bay, Bramshaw (New Forest), and Barton. The species appears to be confined to England.

### No. 121. Mitra porrecta. *F. E. Edwards.* Tab. XXIV, fig. 7 *a—c.*

Mitra porrecta, *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 258.

*M. testá elongato-fusiformi, gracili, ad basin concentricè sulcatá, cæterum lævi; spirá porrectá: anfractibus depresso-convexis, unico sulco prope marginem suturalem circumdatis; marginibus posticis simplicibus: aperturá angustá, lineari; labro acuto, intús crenulato; columellá quinquies plicatá.*

Shell elongated, fusiform, slender; smooth, except at the base, where it is traversed by several broadish, obscure furrows; the spire elevated, nearly equalling the aperture in length; the volutions, seven or eight, flatly convex, with the posterior margins simple, and bordered by a deep furrow, which runs round the shell near the suture. The aperture is narrow, with nearly parallel margins; the outer lip sharp-edged, and finely and regularly crenulated within; the columella presents five sharp folds, of which the anterior two are very oblique, and much smaller than the others.

In the smooth surface, margined whorls, sharp outer lip, and columellar folds, this Mitra resembles *M. marginata* (Lamk.), from the Paris basin. It is, however, a much narrower and more slender shell; the margins of the whorls are without the crenulations which characterise that species, and the outer lip is finely crenulated within. The species appears to be perfectly distinct.

*Size.*—Axis, 4-12ths of an inch; diameter, 1-8th of an inch.

*Localities.*—Barton, Bracklesham Bay.

### No. 122. Mitra obesa. *F. E. Edwards.* Tab. XXIV, fig. 4 *a—d.*

*M. testá ovato-oblongá, ad basin concentrice sulcatá, cæterum lævi; spirá acuminatá, aperturam in longitudine vix æquanti; anfractibus convexiusculis, antice coarctatis, postice marginatis; aperturá elongato-ovali; columellá terties plicatá.*

An ovately oblong shell, smooth except at the base, where it is traversed by a few obscure furrows; spire elevated, nearly as long as the aperture, and terminating in a small, pointed pullus, formed of two round, smooth, unequal volutions; the whorls, which are five in number, exclusive of the embryo, are flatly convex, and contract rather suddenly in front; the posterior margin is bordered by a shallow furrow, which runs round the suture, and the edge is depressed and flattened, giving somewhat of a turreted appearance to the spire. The aperture is ovate, moderately wide, and terminates in front in a short, wide canal, formed by the sudden contraction of the whorl; the columella is nearly straight, and presents three oblique distant folds.

The general form, the width and greater size of the shell, and the number of the columellar plaits, distinguish this species from the smooth variety of *M. parva,* and from *M. gracilis.* It is extremely rare: the specimen figured is, I believe, unique.

*Size.*—Axis, 5-12ths of an inch; diameter, rather more than 2-12ths of an inch.

*Locality.*—Highcliff.

### No. 123. Mitra volutiformis. *F. E. Edwards.* Tab. XXIV, fig. 5 *a—c.*

Mitra volutiformis. *Morr.* 1854. Cat. Brit. Foss., 2d edit., p. 258.

*M. testâ parvâ, oblongâ, turritâ, longitudinaliter costatâ, antice transversim lineatâ, postice concentrice sulcatâ, cæterum lævi: spirâ exsertâ, in longitudine dimidium totius testæ superanti: anfractibus planis, antice subito coarctatis, ad suturas marginatis et unicâ serie tuberculorum instructis; costis crebris, elevatis, rectis, fere ad basin tendentibus, postice nodulosis: aperturâ angustâ; labro intus plicato; columellâ quadriplicatâ; labio angustissimo, postice incrassato.*

Shell small, oblong, turreted, longitudinally ribbed; spire elevated, exceeding the aperture in length; whorls five or six, exclusive of the embryonal whorls, with the sides nearly straight, and contracting suddenly towards the base, where they present five or six transverse, coarse, raised lines; the sutural margin is bordered by a single row of round tubercles, corresponding with the ribs; the posterior surface is concentrically furrowed; the middle surface smooth; the ribs, which are numerous, prominent, and straight, extend to the transverse raised lines on the base, and terminate, posteriorly, in a double row of knobs or tubercles, somewhat larger than those which run round the suture, and from which they are separated by a deep furrow. The aperture is lanceolate, and, owing to the contraction of the whorls, terminates anteriorly in a short, narrow canal, which is slightly emarginate in front; the outer lip is plicated within; the inner lip very narrow, and thickened near the suture, where it forms an oblong callus; the columella is slightly curved, and furnished with four oblique folds, gradually increasing in size as they ascend the columella.

The specimen figured is, I believe, unique. It is apparently an immature shell; but the characters are so strongly marked, and so distinct from those of the other English Eocene Mitræ, that it cannot be passed unnoticed.

*Size.*—Axis, 3-12ths of an inch: diameter, somewhat less than 2-12ths of an inch.

*Locality.*—Barton.

## *Family*—Conidæ.

### Genus 25th. Conus. *Linn.*

Conus *Brug.; Lamarck; Cuvier; De Blainv.*
Voluta, *Browne* (not *Linn.*), 1756.
Strombus, *Adan.* (not *Linn.*), 1757.
Cucullus, *Bolten*, 1798.
Conarius, *Dumér.*, 1806.
Rhombus, *Montfort*, 1810.
Conulus, *Rafin.* (not *Fitzing.*), 1814.
Puncticulis—Coronaxis—Conilithes, *Swains.*, 1840.
Stephanoconus, *Mörch*, 1852.
Cylindrella, *Swains.* (not *Pfeiffer*), 1840.
Dendroconus, *Ib.* 1840.
Lithoconus, *Mörch*, 1852.
Cylinder, *Montfort*, 1810.
Textilia, *Swains.*, 1840.
Hermes, *Montfort*, 1810.
Theliconus, *Swains.*, 1840.
Leptoconus, *Ib.* 1840.
Rhizoconus—Chelyconus, *Mörch*, 1852.
Sect. α Nubecula, *Klein*, 1753.
Rollus, *Montfort*, 1810.
Utriculus, *Schum.*, 1817.
Tuliparia, *Swains.*, 1840.
Sect. β Conorbis, *Ib.* 1840.

*Gen. Char.*—Shell inversely conical, turbinate, rarely ventricose, smooth or concentrically furrowed or striated; spire truncate, short, or more or less elevated; whorls numerous, coronated or simple; aperture linear, narrow, slightly effuse, and emarginate in front; outer lip thin, and sharp at the edge, smooth, sometimes thickened within, generally straight, occasionally curved, notched at the suture; columella straight, smooth, truncate in front; covered with an epidermis, and operculated; operculum small, corneous.

In the genera which constitute the families *Cypræidæ* and *Volutidæ*, the animals are distinguished by their large mantles, capable, as we have seen, of great extension. In the present genus, the type of the family to which its name is given, the animal is furnished with a narrow mantle, prolonged in front into a short, fleshy siphon, resembling that of the Volutes and Mitres, by which water is conveyed to the branchial chamber. The head is small, and carries two subulate tentacles, near the free extremities of which the eyes are placed: it terminates in a retractile, proboscis-like muzzle, at the end of which is the mouth, surrounded by a funnel-shaped veil: the teeth are elongate, subulate, and arranged in two series. The foot is simple, oblong, narrow, and truncated in front; in the middle it presents a pore, the function of which is not ascertained; and it bears, on the posterior extremity, a small, ovate, horny operculum, barely exceeding in length a third part of the aperture, and very narrow, so as to permit the animal to withdraw far within the shell. The epidermis, which covers the shell, is thick, and frequently very tenacious.

The cone-animal is endowed with the power of dissolving the calcareous matter on the outer surface of the inner whorls, which are thus made exceedingly thin, whatever degree of thickness they may have originally possessed. This power of absorption is possessed by many other molluscs, but, according to Mr. George Sowerby, is confined to those furnished with an operculum. It affords a valuable assistance to the Palæontologist.

The present genus, although comprising very many species, remains almost as Linnæus left it. The foregoing list of synonyms shows, indeed, that many dismemberments have been proposed; but at present these appear to depend principally on differences in the shells. In Klein's proposed genus *Nubecula*, however, the shell of which is sub-cylindrical, the animal, according to M. Quoy,[*] is furnished with a large foot, not entirely retractile within the shell; the margin of the muzzle is fringed, and the operculum is curved and unguiculate: these peculiarities apparently justify the division in question being retained as a sub-genus.

The wide semicircular notch which, in many of the cones, separates the outer lip from the suture, closely resembles the sinus characteristic of the Pleurotomæ, and in some of the fossil species in which the outer lip is generally very much curved, it is difficult to determine to which genus the particular shell should be referred. In the well-known Eocene species, *Conus dormitor* (Sol.), for instance, the shell outwardly possesses quite as much of the character of a *Pleurotoma* as of that of a *Cone;* and Mr. Swainson has, in fact, taken it as the type for a genus which he has named *Conorbis*, and which, in his circle of affinities of the *Coninæ*, he regards as the representative of the *Pleurotomæ*. This division depends entirely on the external characters of the shell: no living representative, I believe, has as yet been found, and the animal is therefore unknown. It is certain, however, that it was a true cone-animal; for, on breaking the shell of a specimen of *Conus dormitor,* the inner whorls will be found reduced by absorption to a membrane-like thinness; and the capability to effect this is not, I believe, possessed by the animal of *Pleurotoma.* The proposed genus is not well defined by its author, and is not generally received, although it may be usefully adopted as a section of the present genus. The characters appear to be the elevated conical spire, the produced base representing the canal which distinguishes the *Pleurotomæ*; the condition of the outer lip, which is much thickened within, and so strongly arched as to be almost semicircular in form; the deep, wide sinus, which divides the posterior extremity of the outer lip from the suture, and exactly resembles the notch by which the *Pseudotomæ* (a section of the *Pleurotomæ* proposed by Bellardi) are distinguished; and the elevated, reflected anterior margin of the columellar lip, forming the right wall of the anterior canal.

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[*] Zoologie of the Voyage of the *Astrolabe.*

The recent cones, distinguished by the beauty and variety of their colouring, are very numerous: three hundred and sixty-nine species are enumerated by Messrs. Henry and Arthur Adams in the different divisions adopted by those authors; and, excepting two species which are found in the Mediterranean, all are inhabitants of tropical seas, abounding chiefly in those of Asia. They inhabit fissures and holes in rocks, and coral reefs, ranging in depth from low-water mark to thirty or forty fathoms.

In a fossil state, the genus first occurs in the upper cretaceous strata. M. Deslongchamps, it is true, has referred to it certain shells from the lias of Calvados, exactly resembling cones in outward form, and which, if the genus were correctly determined, would present the anomaly of the cones not being represented during the long epoch which elapsed between the deposit of the middle lias and that of the upper chalk. M. D'Orbigny, however, found, on examination, that the inner whorls were as thick as the outer ones; and from this circumstance he has inferred that the shells in question are not true cones, and he has referred them to *Acteonina*, a genus peculiar to the Oolitic formations, and proposed by him for certain Acteon-like shells, without teeth or folds on the columella. And thus the apparent anomaly disappears. In Europe two species only have hitherto been found in the Chalk—one from Tours, described by Dujardin; the other from Martigues (Bas du Rhone), described by Mathéron: and from the eocene strata, sixteen species have been described by Solander, Bruguière, Lamarck, Sowerby, and Deshayes. After the eocene era, the genus disappears from our Fauna; although, on the Continent, it appears to have been largely developed during the miocene and pleiocene epochs, sixty-seven species having been described by Grateloup, Michelotti, Brocchi, Borson, and other authors, from the formations of those periods, in France, Italy, and Germany. In America only four species, I believe, have as yet been found—one in the Chalk of South Carolina, a second in the eocene strata of Alabama, and two in the more recent formations.

### No. 124. CONUS DIADEMA, *F. E. Edwards.* Tab. XXIV, fig. 8 *a—d*.

CONUS DIVERSIFORMIS, *Sow.* (non *Desh.*) 1841. Min. Con., vol. vii, p. 26, t. 623, figs. 3, 4, 6.
— — *Morris.* 1843. Cat. Brit. Foss., p. 143.
— — *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 108, t. 8, fig. 10.
— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 244.

*C. testá conicá, oblongá, sub-turritá, coronatá, lævi, ad basin transversim obscure sulcatá; spirá elevatá, sed trientem totius testæ longitudine nequaquam æquanti; anfractibus numerosis, angulatis, marginibus posticis depressis, sub-cavatis, concentrice lineatis: aperturá angustá; labro mediocriter arcuato, postice late emarginato.*

*Var.* PYRIFORMIS (fig. 8 *d*). *Testá spirá depressá.*

CONUS PYRIFORMIS, *Sow.* 1850. Dixon's Geol., &c., of Suss., pp. 108 and 189, t. 8, fig. 18.
— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 244.

A smooth, oblong, conical shell, with a turreted spire, formed of numerous (10—12) volutions, and moderately elevated, varying to some extent in different individuals, but never attaining a height equal to a third part of the length of the shell. The whorls are nearly straight on the sides, with the posterior margins much depressed, somewhat concave, and ornamented with four or five thickish, concentric, raised lines, separated by shallow, rounded furrows; the angles of the whorls present a series of oblong, regular tubercles, which are continued almost to the last whorl, when they are replaced by a rounded, cord-like thickening of the shoulder; the front part of the whorls is traversed by shallow, irregular furrows, which are effaced towards the middle part of the shell. The aperture is narrow, with parallel margins; the outer lip moderately arched, and presenting a wide, shallow curvature between the angle and the suture.

The specimens separated by Mr. Sowerby, under the specific name *pyriformis*, have a much depressed spire associated with the tuberculation, and other characters which distinguish the present species, of which, therefore, I regard them as a variety only.

The shells for which I propose the specific name, *C. diadema*, were referred by Mr. Sowerby, in part to *C. deperditus* (Brug.), and in part to *C. diversiformis* (Desh.). In the former species, however, the shell is narrower and more turbinate, with a more curved outer lip, and the tuberculation on the spire, where it occurs, is feeble and lost on the very early whorls; and in the latter species, M. Deshayes, in his description, states expressly that the angles of the whorls are somewhat sharp, and always simple;*

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* It is somewhat difficult to appreciate the distinct specific value of the shells constituting the species *C. diversiformis*, without an examination of a series of specimens equal to that upon the study of which M. Deshayes proposed the separation. To the unschooled eye they appear to be only broader forms of *C. deperditus*, with more variable spires.

while in the English shells, the angles of the whorls are blunt and strongly tuberculated, resembling in that character *C. sulciferus* (Desh.), to which, indeed, I should be inclined to refer them, notwithstanding the transverse sulcation from which the name is taken, but on which much stress is not to be placed, as it does not appear to be a strongly marked character; the shell of *C. sulciferus*, however, is thick and ponderous, with a narrower aperture, and a deeper curvature in the outer lip. In *C. Lamarckii* (a name which I propose to give to the eocene species still miscalled *C. antediluvianus*), the tubercles are also found, but they are not so prominent nor so persistent as in the present species; the shell, also, is narrower, with a sub-conical and more elevated spire, and it never attains the size of *C. diadema*. The only other eocene tuberculated species at all resembling the present one, is *C. crenulatus* (Desh.); but in that species the shell is perspicuously furrowed, even in its mature state, and the spire is shorter and more conical.

*Size.*—Axis, 2 inches and 10-12ths (72 millim.); diameter, 1 inch and 8-12ths (42 millim.).

*Locality.*—Bracklesham Bay, where it is common.

### No. 125. Conus deperditus. *Bruguière.* Tab. XXV, fig. 2 *a—c.*

*D'Argenv.* 1742. Conchyl. Append., 2d edit., p. 349, t. 29, fig. 8.
? *Walch.* 1768. Traité des Petrifact., vol. ii, p. 102, t. 43, fig. 4.
*Favanne.* 1780. D'Argenv., Conchyl., 3d edit., t. 66, fig. G 1.
Conus deperditus, *Brug.* 1789. Encycl. méth., vol. i, p. 691, No. 80, t. 337, fig. 7.
— — *Lamk.* 1802. Ann. du Mus., vol. i, p. 386; vol. xv, p. 441, No. 6.
— — *Def.* 1818. Dict. des Sci. nat., vol. x, p. 261.
— — *Lamk.* 1822. Hist. Nat., vol. vii, p. 528, No. 6.
— — *Desh.* 1823. Dict. class. d'Hist. nat., vol. iv, p. 388.
— — *Ib.* 1824—37. Descr. des coq. foss., &c., vol. ii, p. 745, t. 98, figs. 1, 2.
— — *Galeotti.* 1837. Const. géog., &c., de Brabant, p. 148, No. 63.
— — *Bronn.* 1838. Lethæa geog., vol. ii, p. 1118, t. 42, fig. 14. (ex plur. syn.)
— — *Sow.* 1841. Min. Con., vol. vii, p. 25, t. 623, fig 5 (non figs. 1, 2).
— — ? *Nyst.* 1843. Coq., &c., de Belg., p. 583, No. 501.
— — *Morris.* 1843. Cat. Brit. Foss., p. 143.
— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 355, No. 336.
— — ? *Bell.* 1851. (Foss. nummul. du Comté de Nice), Mém. de la Soc. Géol. de France, 2d ser., vol. iv, p. 219, No. 65.
— allioni? *Beyr.* (non *Michel.*) 1853. Die Conchyl. des Norddeut. tertiär., p. 24, t. 1, figs. 4—6.
— deperditus, *Roissy.* 1804. Buff. Moll., vol. xlv, p. 409, No. 10.
Conilithes cingulatus, *Schlot.*? 1820. Die Petrif., vol. i, p. 125, No. 3.

Nec Conus deperditus, *Brocc.* 1814. Conch. Foss. Sub-app., vol. ii, p. 592, No. 10, t. 3, fig. 2.
nec — — *Bors.* 1821. Oritt. Piem., p. 14, No. 13.
nec — — *Brongn.* 1823. Terr. tert., &c., du Vicentin, p. 32.
nec — — *Bast.* 1825. Desc. des coq. foss., &c., de Bord., p. 39.
nec — — *Bronn.* 1831. Italiens tertiärgeb., p. 12, No. 5.
nec — — *Pusch.* 1837. Polens Palæont., p. 115, No. 2.
nec — — *Grat.* 1838. Cat. zool., &c., de la Gironde, p. 47, No. 422.
nec — — *Ib.* 1838. Tabl. statist. &c., de l'Adour, t. 19, No. 22.
nec — — *Ib.* 1840. Conchyl. foss., &c., de l'Adour, t. 2, figs. 18, 19.
nec — — *Sismon.* 1847. Synop. method., &c., Pedem. Foss., p. 44.
nec — — *Sow.* 1850. Dixon's Geol., &c., of Sussex, p. 108, t. 8, fig. 9.

*C. testá turbinatá, elongatá, lævi, ad basin transversim obsolete sulcatá; spirá prominulá, acutiusculá: anfractibus numerosis, angustis, angulatis, marginibus posticis depressis, strias tenues concentricas gerentibus; ultimo anfractu regulariter conoideo, sursum dilatato: aperturá angustá; labro tenui, simplici, valde arcuato, postice profunde emarginato.*

Shell oblong, turbinate, with a moderately elevated mucronate spire, variable in height, but rarely exceeding a fourth part of the whole length of the shell, and terminating in a smooth, conical pullus, formed of three volutions; whorls numerous (10—12, exclusive of the pullus), bluntly angulated at the shoulders, nearly straight on the sides, with the posterior margins depressed, narrow, somewhat concave, and concentrically lined; the concentric lines are usually four or five in number, sharp, irregular, unequal, separated by moderately deep, rounded furrows, and frequently decussated by the lines of growth. In some specimens the early whorls are very finely tuberculated on the shoulders, and concentrically sulcated; the tubercles, however, disappear after the third or fourth volution, and the shoulders are afterwards smooth and simple: the concentric furrows also become gradually effaced on the posterior portion of the whorls as the shell approaches maturity, and ultimately are altogether lost, leaving only a few very obscure waved furrows traversing the base of the shell. The last whorl is conical, much attenuated in front, with nearly straight sides; the aperture is linear and narrow; the outer lip, which is thin, sharp-edged and much arched, presents a shallow but wide curvature at the posterior extremity.

M. Deshayes states that traces of the natural colouring are sometimes found in the French shells, consisting of narrow, transverse bands, occasionally interrupted by irregular, zigzag patches, following the direction of the lines of growth. Similar traces appear, though very rarely, in the English specimens.

This species appears to be confined to the middle eocene strata; for the shells from Ronca (Vicent.), described by Brongniart as *C. deperditus*, D'Orbigny regards as belonging to a distinct species, which he has named *C. Brongniartii*, and to this species the shells described by Bellardi from the nummulitic beds at Nice, probably are also referrible. Subsequent comparison has shown that specific differences also exist in the various shells from the more recent deposits which have been referred to the present species. Thus the Sub-apennine shells, described by Brocchi, and those from Perpignan and Cassel, recorded by Sismonda, have been separated by Bronn under the name *C. Brocchii;* while to those from Dax and Gaas, described by Grateloup, M. D'Orbigny has given the name *C. Grateloupi;* and he has referred to the same species certain shells described by Pusch, to which Eichwald had given the name *C. argillæcola.* The cones described by Mr. Sowerby as belonging to the present species are young shells of *C. diadema.*

Dr. Beyrich ('Die Conchylien des Norddeutschen tertiärgebirges,' vol. i, p. 24) has described some shells from the North German tertiaries, which he has referred to *C. Allioni* (Michel.), but which agree so well with the present species, that it is difficult to separate them. That author states that, in *C. deperditus* of the Paris basin, the shells are comparatively wider, the concentric lines on the margins of the whorls more strongly marked, and the angles at the shoulders sharper than in the German specimens. These differences do not appear to be greater than may be fairly attributed to variations of local conditions, and I have therefore cited Dr. Beyrich's shell, but with a query. The English shells are wider, and appear to have attained a greater size, than the French shells; and the edges of the shoulders, instead of being somewhat sharp and elevated, as in the latter, are rounded or flattened obliquely; in all other respects our shells agree so well, that I have no doubt of their specific identity.

*Size.*—Axis, 2½ inches, nearly (63 millim.); diameter, 1 inch and 5-12ths (36 millim.).

*Localities.*—Bracklesham Bay, Bramshaw (New Forest), at which places they are not uncommon. *French*—Grignon, Parnes, Mouchy, Courtagnon, &c. (fide *Desh.*) *Belgian*—Affllighem (fide *Galeotti*), Rouge-Cloître, Saint Josse-ten-Noode and Groenendael (fide *Nyst*). *German*—Westeregeln in Magdeburgh, Hermsdorf, Freinwalde and Buckow, and Freden, near Alfeld (fide *Beyrich*). *Italian*—La Palarca (fide *Bellardi*)?

### No. 126. CONUS VELATUS, *Sowerby.* Tab. XXIV, fig. 12.

CONUS VELATUS, *Sow.* 1841. Min. Con., vol. vii, p. 27, t. 623, fig. 7.
— — *Morris.* 1843. Cat. Brit. Foss., p. 143.
— — *Sow.* 1850. Dixon's Geol., &c., of Sussex, pp. 108 and 189, t. 8, fig. 17.
— — *Morris.* 1854. Cat. Brit. Foss., p. 244.

*C. testâ lævi, oblongâ, turbinatâ, antice sub-productâ; transversim obsolete sulcatâ; spirâ conicâ, prominulâ, trientem totius testæ longitudine paulo superanti: anfractibus angulatis, inermibus; marginibus posticis declivis, sub-concavis, lineas concentricas et rugas* *curvas obliquas sese decussantes gerentibus, ad suturam incrassatis, plicatis: aperturâ angustâ; labro valde arcuato, postice late emarginato.*

Shell smooth, oblong, turbinate, somewhat produced at the base, where it presents traces of transverse sulcation: spire conical, slightly elevated, barely exceeding in height a third part of the whole length of the shell: whorls narrow, angulated, and smooth round the shoulders; the posterior margins much depressed, very slightly concave, and presenting four or five rather coarse, raised, concentric lines, which are crossed and decussated by prominent, curved, wrinkle-like elevations, corresponding with the curvature in the outer lip; the edge is thickened, and presents a raised border round the suture, plicated by the extension of the marginal wrinkles over the surface. The aperture is narrow; the outer lip much arched, and separated from the suture by a wide, moderately deep curvature. The surface of the shell is much eroded, and the lines of growth are consequently more conspicuous than is usually the case; these, with the decussated lines on the spire, "give the shell," Mr. Sowerby says, "the appearance of having been enclosed in a net or net-veil; whence the name."

The specimen from which the figure is taken, and on which the species was founded, forms part of Mr. Bowerbank's collection, and is, I believe, unique. In the general character the shell resembles *C. deperditus;* but the more elevated posterior margins, the thickened and plicated edges of the whorls in the present species, apparently justify the separation.

*Size.*—Axis, 1 inch and 4-12ths; diameter, 5-12ths of an inch.

*Locality.*—Bracklesham Bay.

### No. 127. CONUS LAMARCKII, *F. E. Edwards.* Tab. XXV, fig. 3 *a*—*c*.

CONUS ANTEDILUVIANUS, ***Desh.*** (nec ***Brug.***, nec ***Lam.***) 1824—37. Descr. des coq. foss., &c., vol. ii, p. 749, t. 98, figs. 13, 14.
— — ***Bronn.*** 1838. Lethæa Geog., p. 1118.
— DEPERDITUS, ***Sow.*** (non ***Brug.***), 1850. Dixon's Geol., &c., of Sussex, p. 108, t. 8, fig. 9.
— ANTEDILUVIANUS, ***D'Orb.*** 1850. Prod. de Paléont., vol. ii, p. 355, No. 335.
— CONCINNUS, ***Phil.*** (non ***Sow.***) 1846. Tert. foss. Magdeb. (Paleont., vol. i, p. 80, No. 183).
— — ***Beyr.*** (non ***Sow.***) 1853. Die Conchyl. des Norddeutsc. tertiärg., vol. i, p. 21, t. 1, fig. 2.

*C. testâ oblongo-turbinatâ, lævi, ad basin transversim sulcatâ; spirâ elevatâ, acuminatâ, trientem totius testæ longitudine superanti: anfractibus angustis, nodulosis, marginibus posticis oblique depressis, sub-concavis, ad suturam tenuiter plicatis; anfractu ultimo conico: aperturâ lineari, angustâ; labro tenui, arcuato, postice emarginato.*

*Var.* **FILIFER.** *Testâ latiori; marginibus posticis anfractuum concentrice lineatis; lineis irregularibus, aliquando granulatis.*

Shell oblong, inversely conical, smooth, with an elevated, nearly conical spire, in height a little exceeding a third part of the whole length of the shell, and terminating in a small pointed pullus of three volutions. The whorls, 8—10 in number, exclusive of the pullus, are narrow, angulated at the shoulders, the posterior margins slanting backwards towards the preceding whorl, and concave; the sutural edge finely plicated by the strongly marked lines of growth. The early whorls present on the shoulders a row of small rounded tubercles, which are continued, more or less, on the later whorls, in different individuals. The aperture is straight and narrow; the outer lip thin, sharp-edged, not much arched, and separated from the suture by a wide, shallow curvature.

In the specimens from Bracklesham Bay, forming the variety *filifer*, the shells are wider than in the type, the posterior margins of the whorls present concentric lines, variable in number, and occasionally finely granulated where they are decussated by the lines of growth, and a single row of very small, bead-like knobs runs round the sutural edge, instead of the plication usually found there, in this respect somewhat resembling *C. concinnus*. The specimens from Bramshaw agree better with the French shells than do those from Bracklesham Bay; in the latter the shells generally are somewhat wider, the tubercles on the angles of the whorls disappear more early, and the shoulders are blunter than in the typical form. I regard these differences, however, rather as merely local variations than as sufficient to justify the separation of the shells from the present species, with which they agree in the elevated spire, the slanting concave margin and crenulated edge of the whorls, and the size of the shell itself.

With regard to the nomenclature of the French shell, much confusion has arisen, the origin of which is explained by M. Deshayes in a note in the 2d edition of Lamarck's 'Histoire Naturelle' (vol. xi, p. 155). From this it appears that the shell described by Bruguière as having been found at Courtagnon, and to which he gave the name *C. antediluvianus*, was, in fact, a Sub-apennine shell, and that Lamarck, misled by this, quoted *C. antediluvianus* as a Paris-basin species in his Mémoire, published in the 'Annales du Musée.' In 1814, Brocchi, in his work, applied the name given by Bruguière to the Sub-apennine shells, to which it strictly and properly belongs; but Lamarck, in 1822, in the first edition of his 'Histoire Naturelle,' again recorded Bruguière's species as occurring in the environs of Paris. Subsequently, M. Deshayes, in his 'Description des coquilles fossiles,' &c., pointed out the fact that Bruguière's description referred to an Italian species not found in the Paris basin; but unfortunately, in describing the French Eocene shells, he applied Bruguière's name to them. Bronn also, in the 'Lethæa Geognostica,' retained the name *C. antediluvianus* for the Paris-basin species, erroneously associating it with *C. concinnus* (Sow.), a species perfectly distinct; and he proposed the specific name *C. Apenninicus* for the Sub-apennine shells. The same author subsequently, in his 'Index Palæontologicus,' again united the so-called *C. antediluvianus* of the Paris basin with the English *C. concinnus*, retaining for them the name of the latter. It is obvious that the name *antediluvianus* belongs to the Sub-apennine shell, and cannot be applied correctly to the French eocene species; and the attempts of MM. Bronn, Nyst, and others to remove the difficulty by giving a new name to the Italian species, can but increase the confusion. Dr. Beyrich, who fully appreciated the specific distinctness of the forms, has observed ('Die Conchyl.,' &c., p. 20), that "there will not be any necessity for a new name for the older eocene species of the Calcaire Grossier if the union proposed by Bronn be adopted." In the description of *C. concinnus*, I have stated the characters in which I consider that species to be perfectly distinct; and it is a cone which, although recorded by Mr. Sowerby as occurring at Barton, is, I believe, peculiar to the older eocene strata, and cannot be associated with the present species. It becomes necessary, therefore, to give a new name to the middle eocene species, and I propose to distinguish it as *C. Lamarckii.*

*Size.*—Axis, 1 inch and 7-12ths (40 millim.); diameter, 9-12ths of an inch, nearly (18 millim.).

*Localities.*—Bracklesham Bay, Bramshaw. *French*—Parnes, Mouchy, Courtagnon (fide *Desh.*); Vaudancourt, Hermes (fide *D'Orb.*).

## No. 128. Conus concinnus, *Sowerby*. Tab. XXIV, fig. 13 *a—c*.

Conus concinnus, *Sow.* 1821. Min. Con., vol. iii, p. 180, t. 302, fig. 2.
— — *Morr.* 1843. Cat. Brit. Foss., p. 142.
— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 356, No. 337.
Nec — — *Phil.* 1846. Tert. Foss. Magdeb. (Palæont., vol. i, p. 80, No. 183).
nec — — *Beyr.* 1853. Die Conchyl. des Norddeutsc. tertiärg., vol. i, p. 21, t. 1, fig. 2.

*C. testá elongato-turbinatá, lævi, ad basin concentrice sulcatá; spirá elevatá, sub-conica: anfractibus angustis, sub-planis, angulatis, ad angulos nodulosis; marginibus posticis declivis, duas vel tres lineas elevatas granulatas gerentibus, ad suturas marginatis, plicatis vel moniliferis: aperturá angustissimá; labro valde arcuato, postice late emarginato.*

*Var. β. Testá spatiis inter suturas et angulos anfractuum tres vel quatuor lineas elevatas simplices gerentibus.*

Shell elongate, turbinate, concentrically furrowed at the base; spire elevated, but variable in height, sometimes nearly equalling a half, sometimes not much exceeding a third part, of the whole length of the shell: whorls seven or eight, exclusive of the pullus, very narrow, nearly straight on the sides, angulated at the shoulders, with the posterior margins slanting backwards; the edges round the suture thickened, and either plicated or furnished with a single row of rather small bead-like nobs; the space between the edge and the shoulder is straight, and ornamented with two or three concentric raised lines, very finely granulated. The shoulders bear a single row of prominent, round tubercles, placed at regular and not distant intervals, and continued throughout. The aperture is straight, and very narrow; the outer lip much arched, and presenting a wide, shallow curvature at the posterior extremity. The concentric furrows cover the whole surface of the young shell, but become more or less effaced as the shell is enlarged, and on the last whorl they are confined to the anterior portion of the shell; through all stages of growth the basal furrows are deep and sharp-edged.

A variety occurs at Lee, near Southend, in which the sutural edge and margin of the whorl present four thick, prominent lines, rounded and smooth on the upper surface, and devoid of the granulations which characterise the type.

I have already noticed the fact, that Bronn has regarded the present species, apparently confined to the lower eocene strata, as identical with the so-called *C. antediluvianus* of Lamarck; and Dr. Beyrich, adopting that opinion, has applied the name *concinnus* to a shell from the German Tertiaries which belongs to *C. Lamarckii.* The narrower form, the smaller number of the volutions, the large rounded tubercles on the shoulders, the more depressed margins of the whorls, with their thickened edges and concentric rows of granulations, or strong elevated lines, and the deep, sharp-edged furrows, barely effaced on the posterior part by the outer coating of the shell,—appear to me sufficiently to distinguish the present shells from those of the middle eocene epoch. I do not agree, therefore, with M. Bronn and Dr. Beyrich, in referring both to the same species; and in this view, apparently both M. Deshayes and M. D'Orbigny concur.

*Size.*—Axis, 1 inch and 3-12ths (32 millim.); diameter, rather more than 6-12ths of an inch (between 13 and 14 millim.).

*Localities.*—Highgate; Fortess Green, near Kentish Town; Lee, near Southend. Mr. Sowerby cites Barton, but I have never met with any specimen from that locality; and the specimen on the authority of which Barton is cited ('Min. Con.,' t. 302, lowest fig.) does not present the characteristic form of *C. concinnus;* it is much mutilated, but it has rather the appearance of a worn specimen of *C. scabriculus.* M. Deshayes (2d edit. of 'Lam. Hist. Nat.') states that this species occurs in the environs of Paris; it is not mentioned, however, in his 'Description des Coquilles Fossiles,' and M. D'Orbigny has not given any French locality for it. At present this cone appears to belong exclusively to the earlier eocene fauna.

### No. 129. Conus scabriculus, *Solander*. Tab. XXIV, fig. 9 *a—c*.

Conus scabriculus, *Sol.* 1766. Brand., Foss. Hanton., p. 15, t. 1, fig. 21.
— — *Sow.* 1821. Min. Con., vol. iii, p. 180, t. 303, figs. 1, 2.
— — *Desh.* 1824-37. Descr. des coq. foss., &c., vol. ii, p. 751, t. 98, figs. 17, 18.
— — *Ib.* 1845. Lam., Hist. Nat., 2d edit., vol. ii, p. 158, No. 11.
— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 416, No. 1472.
non — — *Sism.* 1847. Syn. Meth., &c., Pedemont. foss., p. 44.

*C. testá utrinque conicá, antice sub-productá, lineis concentricis, elevatis, ornatá; spirá elevatá, acuminatá; lineis concentricis acutis, denticulatis, aliquando confertis, aliquando distantibus; alternis sæpissime minoribus, sæpe inermibus: anfractibus planis, postice obtuse angulatis; marginibus sub-concavis, ad suturam granulosis: aperturá lineari, angustá, bessem totius testæ paullum superanti; labro tenuissimo, leviter arcuato, postice sinuoso.*

Shell oblong, doubly conical, slightly produced at the base, and ornamented with concentric raised lines; spire elevated, pointed, terminating in a very small conical pullus, formed of three smooth volutions. The concentric lines are sharp, and very variable in their character; sometimes numerous, sometimes distant, and very frequently the alternate lines are smaller than the others. Most generally the concentric lines rise, at regular intervals, into short, tooth-like tubercles, having their bases prolonged, both in front and behind, into short, rounded ribs, more or less prominent according to the size of the tubercles, and separated by deep, pit-like hollows. The whorls, exclusive of the pullus, are six or seven in number, flat at the sides, slightly contracted towards the base, obtusely angulated at the shoulder, longitudinally ridged by regular conspicuous lines of growth, and bordered at the suture by a row of small granulations; the space between the shoulder and the suture is traversed by two or three smooth, prominent lines. The aperture is straight, narrow, slightly emarginate in front, and in length, rather more than two thirds of the whole shell; the outer lip is smooth within, thin, sharp on the edge, of a flattened elliptical form, and separated from the preceding whorl by a moderately wide, but not deep, sinus. The columella is slightly curved inwards.

Not infrequently, the alternate smaller lines, where they do occur, are smooth and simple; and the same character sometimes, although very rarely, distinguishes the whole transverse lineation. In the latter instances the surface of the shell between the raised lines is flat and smooth, except where it is ridged by the lines of growth.

This pretty and well-marked species is, apparently, confined to the middle eocene strata; and the shells referred to it by Sismonda, from Piedmont and Turin, are considered by M. D'Orbigny to belong, in fact, to Michelotte's *C. ornatus.*

*Size.*—Axis, 4-5ths of an inch; diameter, rather more than 3-10ths of an inch.

*Localities.*—Barton. *French*—Monneville (fide *Desh.*), Chavançon (fide *D'Orb.*).

### No. 130. Conus lineatus, *Solander*. Tab. XXIV, fig. 10 *a—c*.

Conus lineatus, *Sol.* 1766. Brand., Foss. Hanton., p. 15, t. 1, fig. 22.
— corculum, *Sow.* 1841. Min. Conchol., vol. vii, p. 27, t. 623, figs. 8, 9.
— lineatus, *Morris.* 1843. Cat. Brit. Foss., p. 143.
— corculum, *Morris.* 1843. Cat. Brit. Foss., p. 142.
— — *Sow.* 1850. Dixon's Geol., &c., of Suss., p. 109.
— lineatus, *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 355, No. 334.
— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 244.
— corculum. *Ib.* 1854. Cat. Brit. Foss., 2d edit., p. 243.
non — lineatus, *Chemn.* 1795. Conchyl. Cab., vol. x, p. 27, t. 138, fig. 1285.

*C. testá utrinque sub-conicá, lineis concentricis ornatá, antice sub-productá; lineis concentricis æqualibus, lævibus, confertis; spirá elevatá, acuminatá, sub-nodulosá: anfractibus planis, postice obtuse angulatis, marginibus sub-concavis, concentrice lineatis, ad suturam depressis, granulatis: aperturá lineari, angustá, longitudine bessem totius testæ fere æquanti; labro tenuissimo, leviter arcuato, postice sinuato.*

Shell oblong, doubly conical, ornamented with transverse raised lines; spire elevated, coronated, terminating in a small pointed pullus, consisting of two or three smooth volutions; the transverse lines are smooth, regular, numerous, and separated by rather deep, rounded furrows; the whorls, which are five or six in number without the pullus, are flat at the sides, slightly contracted and produced in front, angulated at the shoulders, and depressed at the sutural margins, forming a narrow ledge running round the spire, the outer edge of which is finely granulated; the space between the margin and the shoulder is slightly concave, and presents two or three faint, concentric, unequal, raised lines. The early whorls bear on the shoulders a row of transverse, oblong tubercles, imparting a somewhat nodulous character to the spire, but lost on the last whorl, the shoulder of which is smooth. The aperture is straight, narrow, and about two thirds of the whole shell in length; the outer lip, which is but slightly curved, presents a shallow sinus at the posterior extremity: the columella is nearly straight.

Brander's shell, deposited in the British Museum, is unfortunately mislaid, and I have not been able to compare with it the shells now described. They agree, however, with Solander's description and figure in all respects except in the striation. Brander's shell, which was apparently a larger and an older specimen than any I possess, and was probably somewhat worn, is described as *obsolete striata;* while the transverse lines on my specimen are generally bold and clearly defined.

The Bracklesham Bay shell, described by Mr. Sowerby as *C. corculum,* is a little shorter in the spire; but, in all other respects, it agrees exactly with the present species, to which, therefore, I have referred it.

Lamarck, and, since his time, MM. Deshayes and D'Orbigny, have considered *C. lineatus* as identical with *C. stromboides* (Lamk.), from the Paris basin. These two shells do not appear to me, however, to be referable to the same species, for in the French species the shell is narrower, the spire more elevated, and formed of more numerous volutions; the whorls, also, are more rounded at the shoulders, the transverse lineation is feebler and more irregular, and the outer lip is more strongly arched than in the English shells. I have, therefore, not cited *C. stromboides* as a synonym of the presen species.

So closely does *C. lineatus* resemble *C. scabriculus*, from which, in fact, it is only distinguished by its smooth, crowded, concentric lines, separated by rounded furrows, that it ought, perhaps, to be regarded as merely a variety into which the smooth lined specimens of the latter species would lead; but, without an examination of Brander's shell, I do not venture to question Solander's species.

*Size.*—The dimensions of my largest specimen are—axis, 7-12ths of an inch; diameter, rather more than 3-12ths of an inch: those of Brander's shell were, according to the figure—axis, 10-12ths of an inch; diameter, rather more than 5-12ths of an inch.

*Localities.*—Barton, Bracklesham Bay. Very rare.

### *Section*—CONORBIS.

### No. 131. CONUS DORMITOR, *Solander*. Tab. XXIV, fig. 11 *a—c*.

CONUS DORMITOR, *Sol.* 1766. Brand., Foss. Hanton., p. 16, t. 1, fig. 24.
— — *Sow.* 1821. Min. Con., vol. iii, p. 179, t. 301.
— — *Morris.* 1843. Cat. Brit. Foss., p. 143.
— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 356, No. 338.
— — *G. Sow.* . Gen. of Shells, Conus, fig. 8.

*C. testâ crassiusculâ, fusiformi; utrinque conicâ, concentrice lineatâ, antice sub-productâ, vix emarginatâ, paulo retroflexâ; lineis concentricis elevatis, æqualibus, irregularibus, sub-distantibus; interstitiis concavis, lineis incrementi tenuissime crenulatis: aperturâ lineari, angustâ; labro acuto, rotundato-elliptico, intùs incrassato, postice late sinuato; labii margine anteriori elevatâ, productâ.*

*Var.* SEMINUDA. *Testâ ad basin transversim sulcatâ; anfractibus postice unico sulco exaratis, cæterum lævibus.*

Shell rather thick, fusiform, resembling two nearly equal cones, placed base to base, and ornamented with concentric raised lines; the spire, forming the shorter cone, is elevated, pointed, and terminates in a very small conical pullus of three volutions; whorls seven or eight, exclusive of the pullus, rounded at the shoulders, nearly straight on the sides, somewhat produced in front, and very slightly bent backwards. The concentric lines are equal, not very distant over the middle of the whorls, but varying in that respect in different individuals; more crowded at the base and on the shoulders, distant on the posterior margins, which are much elevated, and pressed against the preceding whorls; occasionally on the last whorl of mature specimens additional faint lines appear. The spaces between the lines are very slightly concave, and finely crenulated by the lines of growth, which are very perspicuous over the whole surface of the shell. The aperture is narrow, straight, except at the base, where it is a little deflected, and scarcely emarginate; the outer lip thin and sharp on the edge, very much thickened within, faintly crenulated on the inner margin by the concentric lines, of a roundedly elliptical shape, and detached from the suture by a wide but very shallow curvature. The anterior margin of the columellar lip is elevated and prolonged in front, where it serves as the wall of the rudimentary anterior canal formed by the produced base of the shell.

In specimens from Brockenhurst and Lyndhurst, the middle and upper parts of the whorls are perfectly smooth, with the exception of a single furrow which traverses the posterior margins; and the base of the shell presents numerous shallow furrows, which extend almost up to the middle of the whorl, instead of the sharp elevated lines which characterise the typical form.

This well-known species, peculiar, I believe, to the Hampshire basin, forms the type of Mr. Swainson's genus *Conorbis*. In the elevated conical spire, the almost semicircular form of the outer lip, and the produced base of the whorls, it presents the closest analogies with that section of the Pleurotomæ formed of *P. prisca*, *P. amphiconus*, *P. linearis*, and similar species. Indeed, so closely does it approach to some of these, that, judging from external characters only, it is difficult to decide to which genus it should be referred. The straight, narrow aperture, however, is certainly that of a cone, and indicates a necessity that the animal, in order that it might withdraw into the inner whorls, should be enabled to enlarge the space within the shell; a necessity which, as I have already stated, was met by the power of absorption possessed by the animal. The curvature in the outer lip, also, is quite distinct in its character from the sinus in the outer lip of the Pleurotomæ.

*Size.*—Type—Axis, 1 inch and 1-12; diameter, 5-12ths of an inch. Var.—Axis, 1 inch and 3-12ths; diameter, 6-12ths of an inch.

*Localities.*—Barton, Alum Bay (No. 29, *Prestwich*), Lyndhurst, and Brockenhurst (New Forest).

No. 132. Conus alatus, *F. E. Edwards*. Tab. XXV, fig. 1 *a*, *b*.

*C. testâ sub-fusiformi, utrinque conicâ, concentrice sulcatâ, antice sub-productâ, retroflexâ, emarginatâ; spirâ acuminatâ, in longitudine trientem totius testæ superanti: anfractibus convexiusculis, sub-angulatis; marginibus posticis angustis, concavis, concentrice sulcatis; sulcis concentricis irregularibus, postice evanescentibus: aperturâ angustâ; labro aliformi, fere semicirculari, acuto, intùs incrassato, antice crenulato, postice perparum breviterque emarginato; labio antice reflexo, producto.*

*Var.* HEMILISSA. *Testâ breviori, latiori, postice lævi; marginibus anfractuum valde cavatis, unico sulco concentrico exaratis.*

Shell nearly fusiform, doubly conical, concentrically furrowed, rather produced and bent backwards at the base, and deeply notched; the concentric furrows are irregular, crowded, and sharp-edged over the base, more distant and obscure as they ascend the shell; the spire is pointed, elevated, rather more than a third part of the whole shell in height, and terminates in a very small, conical pullus. The whorls are rather convex, slightly angulated at the shoulder, and a little thickened on the edge round the suture; the posterior margin is narrow, rather concave, and traversed by two or three deepish furrows. The aperture is narrow and nearly straight, with the anterior extremity slightly curved outwards and backwards; the outer lip is remarkably large, almost semicircular, thickened within, thin and sharp on the edge, and separated from the suture by a very small but rather deep curvature; the inner lip produced, reflexed, and curved backwards; the columella presents a broad, elevated ridge or "crest" in front.

A variety occurs at Brockenhurst, in which the shell is shorter and wider; the posterior portion of the whorl is smooth; the angle on the shoulder sharper and more clearly defined, and the posterior margin more concave, and traversed by a single obscure furrow.

The presence, in this species, of concentric furrows instead of the sharp, elevated lines which characterise *C. dormitor*, is not a character to which much specific value can be attached, as these ornaments interchange by insensible degrees; but the depressed, concave posterior margin of the whorls, the very large wing-like, outer lip, the small, narrow, but deep curvature which separates the outer lip from the suture, and the deep anterior notch, with its usual accompaniment, the elevated crest on the columella, appear to me to justify the separation of the present species. Even the variety which, with its half-smooth half-sulcated surface, so much resembles the *var. seminuda* of *C. dormitor*, is easily distinguishable by these characters.

*Size.*—Type—Axis, 1 inch and 5-12ths, nearly; diameter, rather more than 6-12ths of an inch. Variety—Axis, 1 inch; diameter, ½ inch.

*Localities.*—Type: Bramshaw. Variety: Brockenhurst, Lyndhurst.

## Genus 26th. PLEUROTOMA.* *Lamarck.*

TURRIS, 1797, *Humphreys.*
PLEUROTOMA, 1801, *Lamarck.*
PLEUROTOMARIUS, 1806, *Dumér.*
PLEUROTOMUS, 1810, *De Montf.*
TURRICULA, 1817, *Schum.* (not *Klein*).
PLEUROTOMA, 1840, *Swainson.*
— (exc. sect. A) 1847, *Bellardi.*
SURCULA, 1853, *Adams.*
GENOT, 1757, *Adanson.*
CRASSISPIRA, }
BRACHYTOMA, } 1840, *Swains.*
CONOPLEURA, 1844, *Hinds.*
GENOTA, 1853, *Adams.*
Sect. DRILLIA, 1834, *Gray.*

*Gen. Char.*—*Shell* fusiform, turreted, or conoid, ribbed or concentrically striated, sometimes smooth; spire elevated: aperture oval, terminating anteriorly in a canal more or less elongated; outer lip thin, with a deep fissure or notch near the posterior extremity; columella smooth, nearly straight. *Operculum* pointed, nucleus apical.

This genus, first indicated by Humphreys under the name *Turris,* was established by Lamarck for various shells, which by Linnæus, Chemnitz, and others, had been placed with *Murex,* and by Brugnière with *Fusus.* The animal is very similar to that of the *Cone,* and, like it, presents a strong resemblance to those of the *Muricidæ,* from which it is mainly distinguished by the peculiar character of the dentition. It has a small, flat head, provided with a siphon varying in length, and with cylindrical tentacles wide apart, on bulgings near the bases of which the eyes are placed; and the mouth terminates in a small, fleshy proboscis. The foot is oblong, truncated at each extremity, of nearly uniform width, and thin at the edge; and the mantle has a notch or slit on the right side which corresponds with, and is represented by, the sinus in the shell. The function attributed to this notch is the more ready expulsion of the excretory matter, but the precise way in which it is subservient to that purpose is not known. Apparently it is intended, as Mr. Swainson asserts, for the protrusion of some particular organ of the animal; but the existence of such an organ is not noticed by MM. Quoy and Gaimard in their description of the anatomy of the animal of *Pleurotoma Babylonica,* nor has it as yet been ascertained. The lingual teeth are elongate, subulate, arranged in two series; but, as in the Cone animal, the central or rachidian teeth, usually found in other families, are wanting.

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* Etym. Πλευρά, the side; and Τομὴ, an incision.

When Lamarck first established the present genus, he at the same time separated the species whose shells terminate in a short canal, under the name *Clavatula*, a genus which, as defined by the author, rested wholly on characters taken from the shell, and which was afterwards withdrawn by him as not tenable. In this suppression subsequent writers have concurred until recently, when, a better knowledge of the animal having been acquired, characters have been pointed out which are generally considered as sufficient to justify the separation, and the genus has accordingly been adopted, and has been re-defined by Dr. Gray. The most prominent of these characters are the shape of the foot, which is large and ovular, and the condition of the operculum, the nucleus of which, instead of being apical as in the true *Pleurotoma*, is placed nearly at the middle of the right margin. The shell also, it must be observed, presents an emargination near the anterior extremity of the outer lip, similar to that found among the *Strombidæ*, and a thick callosity at the hind part of the columella near the suture, characters which are not found in the present genus.

The genus *Pleurotoma*, as originally defined, comprised a large number of species, and the list of synonyms shows how strongly the necessity for some subdivision has been felt. Some of the proposed divisions, however, so far as the present imperfect knowledge of the animals will enable the student to estimate their value, appear to rest on conchological distinctions, and as yet are not generally accepted. In others, however, the animals exhibit distinct characters, which, taken in conjunction with modifications of the shells, are received as of sufficient generic value. Thus in *Bela* (Leach), the eyes are placed on the upper part of the tentacles, which are approximate, and the outer lip of the shell is simple, or with a slight sinus confluent with the suture; and in *Mangelia* (Leach; *Defrancia*, Millet; *Raphitoma*, Bellardi), the eyes are sub-pedicelled, the foot is short, tapering behind, and enlarged in front at each corner into a hook-shaped projection, and the dentition, according to Messrs. Forbes and Hanley, presents a simple rachidian tooth in addition to the two lateral subulate teeth of the present genus; the animal, also, is without an operculum, and the outer lip of the shell has a sinus resembling that found in the notched species of *Bela*.* Again, in *Perrona* (Schum.; *Tomella*, Swains.), the nucleus of the operculum is placed near the middle of the right side, as in *Clavatula*, of which genus, in fact, it appears to be only a smooth form; and again, in *Drillia* (Gray), according to Messrs. Adams, the eyes are placed near the lips of the tentacles, which are very slender and approximated, and the outer lip presents a small sinus in front, like the one in *Clavatula* already noticed. A more extended knowledge of the animals may hereafter support others of the proposed genera; but, in the mean time, they can be received only as subdivisions for facilitating the arrangement of the very numerous species which crowd the present genus.

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* Messrs. Forbes and Hanley have united *Mangelia* and *Bela*, using the latter name to distinguish the operculated species from those without an operculum, which, with those authors, form the true *Mangeliæ*.

With regard to the genus *Clavatula*, several shells are found among the English eocene *Pleurotomæ*, which, agreeing with Lamarck's definition of the genus, might be, perhaps correctly, referred to it; but since that genus, as re-defined, depends on zoological characters, and on the condition of the operculum, criteria which are not available to the palæontologist, and the species themselves do not exhibit any characters by which they can be separated from the true *Pleurotomæ*, those shells have been referred, in the following descriptions, to the present genus.

Bellardi, in his elaborate and most useful work, 'Monografia delle Pleurotome fossile del Piémonte,' has divided the Pleurotomæ into three genera, *Pleurotoma*, *Borsonia*, and *Raphitoma*. The first comprises the true Pleurotomæ and the Clavatulæ of Lamarck; and with these are associated some fusiform shells generally referred to *Fusus*, the outer lips of which present, not the true notch or slit characteristic of a *Pleurotoma*, but a wide undulation, which the author regards as a "rudimentary sinus." No other reason is assigned, and this certainly does not appear to be a sufficient one, for placing the shells in question in the present genus. Several of the so-called eocene *Fusi* present this undulation in the outer lip; and inasmuch as to refer them to the present genus would, in my opinion, uselessly create much confusion, I have left them among the *Fusi*, where they were first placed. The second genus, *Borsonia*, is proposed for certain shells in which the true sinus of a Pleurotoma is associated with a fold on the columella.* The remaining genus, *Raphitoma*, consists of those species in which the sinus is very small and confluent with the suture, and the canal is indistinct, a division which corresponds pretty accurately with *Mangelia* (Leach). The *Pleurotomæ* are again divided into three sections, according to the size and shape of the sinus; namely, *Pseudotomatæ*, or false-notched shells, composed of the fusiform species before mentioned, in which the outer lip presents the so-called rudimentary sinus; *megatomatæ*, or widely-notched shells;† and *macrotomatæ*, or deeply-notched shells. The last section is again sub-divided into five groups; *deltoideæ*, in which the canal is but little produced, and the sinus is placed in an angular depression; *pteroideæ*, in which the canal is elongated, the outer lip aliform and produced in front, and the sinus is in a depression; *cariniferæ*, having the canal as long as the spire, and the sinus on a keel; *excavatæ*, in which also the canal is as long as the spire, but the sinus is between the shoulder and the suture; and *hemicycloidales*, having the canal indistinct, and the sinus semicircular, and placed in a depression.

Although this classification will render great assistance in the study of the present genus, the distinctions between some of the groups will, I think, be found to be difficult of practical application; nor will the groups proposed embrace all the forms which occur in the English eocene fauna. The employment of a few broadly marked characters, which the eye can readily seize, will afford, in fact, more effectual aid to the student; and with this view I have adopted the division of the Pleurotomæ, proposed by M. Deshayes, into *fusiformes* and *conoidales;* but the *fusiformes* I have divided into two sections, distinguished by the position of the sinus, a prominent and unvarying character; while the size and, to some extent, the shape of the sinus are subject to modification. The first section will comprise the species in which the sinus is placed in the margin, that is to say the space between the suture and the shoulder, or widest part of the whorl; the second section will embrace those in which the sinus is placed on the shoulder of the whorl. Each of these sections will be sub-divided into two groups, respectively consisting of the species having the canal produced, and the species in which the canal is short or indistinct.

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* Shells referable to this division, as enlarged by Rouault, occur in our middle eocene strata; the genus *Borsonia* will therefore be noticed in its proper place.

† Bellardi cites *Tomella*, Swains., as corresponding with his section *Megatomatæ;* that section, however, consists of two species only, *P. cataphracta*, Broc., and *P. ramosa*, Bast., in both of which the shells are many whorled, turreted, coronated, and concentrically striated, and therefore do not at all agree with Mr. Swainson's definition of his genus *Tomella*.

The genus Pleurotoma is one of peculiar interest; it seems to form a central group, in which either the animals present close affinities with those of the neighbouring genera, or the shells, radiating through aberrant forms in which the typical characters are prominently retained, present striking analogies with those of apparently distant genera; analogies which, if not suggestive of affinities, at least show the repetition of similar forms in dissimilar groups. Thus the passage from the true fusiform *Pleurotomæ* through the conoidal forms of that genus into the species of *Cone* forming the section *Conorbis,* and so into the true Cones, is a transition so gradual and so perfect as in itself to afford the strongest evidence of the intimate connection of the present genus with the Conidæ. So, again, the passage through *Lachesis* into *Murex*—that through the shells before referred to with the so-called rudimentary sinus in the outer lip into the true *Fusus;* and also that through *Borsonia* into *Turbinella* or *Fasciolaria;* while the short posterior canal in the species forming Swainson's genus *Brachytoma,* and the anterior notch on the outer lips of the *Drilliæ,* present strong resemblances to the *Strombidæ.*

The living species of Pleurotoma are very numerous, upwards of 450, including those forming the different sub-genera, having been described: they are found in all parts of the world, but principally in the seas of China and Western America, ranging in depth from low-water mark to 100 fathoms. In the fossil state they first appear in the upper cretaceous strata, from which four species referred to this genus have been described by Goldfuss, Sowerby, and D'Orbigny. During the tertiary epoch the genus was largely developed; upwards of 90 species, from the eocene formations of Europe, have been described by Lamarck, Sowerby, Deshayes, Melleville, and other writers; while from the more recent formations nearly 200 species have been recorded by Brocchi, Grateloup, Basterot, De Koninck, Nyst, Bellardi, Sowerby, S. Wood, Hörnes, and the many other authors who have described the mollusca of the newer tertiary deposits. In the Western hemisphere, which presents a large proportion of the living species, the genus does not appear to have had so large a development; twenty-three species only from the tertiary deposits in the United States have been described by Conrad and Lea, and three species from the newer tertiaries of Chili have been described by Sowerby. The genus is largely represented in the English eocene fauna, but as yet comparatively few species have been described or identified.

The shells of the *Pleurotomæ* appear to have been peculiarly subject to modification by external conditions, and, as De Blainville has remarked, it is "apparently with them as with the *Cerithia*, the *Ammonites*, and other genera which contain many species; each locality presents different forms."

### *Section* I. *Shells fusiform.*

### A. *Sinus in the posterior margin of the whorl.*

### *a. Canal elongated.*

No. 133. **Pleurotoma stena**, *F. E. Edwards.* Tab. XXV, fig. 4 *a*, *b*.

*P. testâ elongato-fusiformi, angustâ, sub-turritâ, fasciis et filis spiralibus, lineis incrementi decussatis, omnino tectâ; spirâ productâ, apice acuminato: anfractibus convexiusculis, angulatis, obtuse carinatis, postice sub-concavis, ad suturam crenulatis; filis concentricis numerosis, inæqualibus; anfractu ultimo antice gradatim attenuato et in canali longo, recto, exeunti: aperturâ elongato-ovali; labro vix arcuato; sinu labrali angusto, profundo in margine collocato.*

Shell elongate, fusiform, narrow, ornamented with numerous spiral bands, the spaces between which, as well as the surface between the shoulder and the suture, and sometimes even the spiral bands, are covered with numerous fine, thread-like, unequal, raised lines, decussated, or rather roughened, by the lines of growth; the spire, which is formed of seven or eight volutions, is much produced; the whorls are slightly convex, sharply angulated at the shoulder; the posterior margins depressed and slightly thickened at the edge, where one or two raised lines, stronger than the others, and crenulated by the lines of growth, run round the suture; the space between the suture and the shoulder is concave, giving somewhat of a turreted aspect to the spire. The spiral bands are irregular, narrow, flat on the surface, sharp edged; the posterior band runs round the shoulder, forming a blunt keel, and the space between it and the band immediately in front of it is wider than those between the other bands, and is concave; the bands, as they approach the anterior part of the shell, become closer, narrower, and less prominent, while, on the other hand, the concentric lines become stronger, more elevated, and more distant, until the two blend together, and form the round, coarse, raised lines which cover the base of the shell and the canal. The body whorl is gradually much attenuated in front, and terminates in a long, nearly straight canal. The aperture is of a lengthened oval shape; the outer lip slightly arched; and the sinus, which is in the middle of the margin, is narrow and deep.

The young shell of the present species presents some resemblance to the variety *Pagoda* of *P. terebralis;* but the latter shell is proportionably wider and shorter, and is distinguished as well by the smooth posterior margins of the whorls as by the sharp-edged keel, which is turned upwards, forming a deep channel round the margin.

*Size.*—Axis, 2 inches and 10-12ths; diameter, 8-12ths of an inch.

*Localities.*—Highgate, Clarendon Hill, Shenfield, and Southampton.

## No. 134. PLEUROTOMA INARATA, *Sowerby*. Tab. XXV, fig. 6.

PLEUROTOMA INARATA, *Sow.* 1850. Dixon's Geology, &c., of Sussex, pp. 102, 183, t. 6, fig. 21.
— — *Morris.* 1854. Cat. of Brit. Foss., 2d edit., p. 270.

*P. testâ elongatâ, fusiformi, spiraliter lineatâ; spirâ conicâ, acuminatâ: anfractibus convexiusculis, postice sub-concavis, marginatis, ad suturam leviter crenulatis; ultimo anfractu in canali longo, angusto, subrecto exeunti; striis spiralibus numerosis, lineis incrementi decussatis, alternis vel trinis crassis, cæteris tenuibus: aperturâ ovatâ; labro arcuato, sinu profundo, sub-trigono, in margine collocato.*

Shell fusiform, elongated, ornamented with spiral, raised lines: spire elevated, conical, pointed: whorls convex, thickened on the margin, where they present a raised border running round the suture, feebly crenulated at the edge, and traversed by two or three slender, concentric, raised lines; the space between the suture and the shoulder slightly concave, and covered with very fine, thread-like, concentric, raised lines, which are crowded near the raised border: the last whorl terminates in an elongated, nearly straight canal, almost as long as the spire. The spiral lines on the middle and front parts of the whorls are numerous, strongly decussated by the lines of growth, and unequal; every alternate or third line being thick, prominent, and sharp on the edges, and the intermediate lines thread-like and slender. The aperture is ovate, the outer lip much arched, and the sinus, which is placed in the depression between the suture and the shoulder, is deep, moderately wide, and sub-trigonal in shape.

This species appears to be the analogue of the Barton and Highcliff species, *P. rostrata,* from which it is distinguished by the absence of the tubercles and the ribs, or undulations on the shoulders.

*Size.*—Axis, 2 inches and 2-12ths; diameter, rather more than 8-12ths of an inch.

*Locality.*—Bracklesham Bay.

### No. 135. **Pleurotoma helix,** *F. E. Edwards.* Tab. XXV, fig. 7 *a*, *b*.

*P. testâ elongato-fusiformi, sub-turritâ, fasciis spiralibus, lineis incrementi asperatis, cinctâ; spirâ elevatâ: anfractibus convexis; marginibus posticis latis, cavatis, lineas concentricas filiformes inæquales gerentibus, ad suturam crenulatis; fasciis spiralibus angustis, numerosis, alternatim majoribus et minoribus: aperturâ elongato-ovali, in canali longo terminanti; labro valde arcuato; sinu angusto, profundo, in margine collocato.*

*Var.* RICNA. *Testâ anfractibus sub-angulatis; fasciis spiralibus numerosioribus, tribus minoribus inter majores apparentibus.*

Shell lengthened, fusiform, and covered with concentric bands, roughened by the strongly marked lines of growth; spire elevated: whorls convex, rounded at the shoulder, produced in front; the posterior margins wide, channeled, and bordered round the suture by two or three bands strongly crenulated; the middle of the margin presents three coarse, rounded, raised lines, and on each side of these three or more fine thread-like lines. The line of the suture is very decurrent, and runs at some distance below the wide part of the whorl, giving a screw-like appearance to the spire. The spiral bands are numerous, rounded at the edges, and unequal, the alternate ones being smaller than the others. The aperture is of a narrow, ovate form, and terminates in a longish straight canal; the outer lip is much arched, and the sinus, which is deep and moderately wide, is placed in the middle of the margin.

Specimens occur at Potter's Bar (var. *ricna*), in which the shoulders of the whorls are angulated, and a fine thread-like line runs on each of the smaller spiral bands.

The specimens figured were obtained from the railway cutting at Primrose Hill, and form part of Mr. Wetherell's collection.

*Size.*—The exact dimensions cannot be given, but those of the largest specimen figured must have been—axis, nearly 3 inches; diameter, 11-12ths of an inch.

*Localities.*—Primrose Hill and Potter's Bar.

### No. 136. **Pleurotoma symmetrica.** *F. E. Edwards.* Tab. XXV, fig. 5 *a*, *b*.

*P. testâ elongato-fusiformi, gracili, spiraliter fasciatâ, in juventâ costulatâ; spirâ elevatâ: anfractibus convexiusculis, marginibus posticis vix cavatis, ad suturam marginatis, crenulatis; ultimo anfractu in canali longo exeunti; fasciis spiralibus irregularibus, lineis incrementi asperatis: aperturâ ovali elongatâ; labro valde arcuato; sinu mediocriter lato, parum profundo, in margine collocato.*

Shell lengthened, slender, fusiform, ornamented with numerous spiral bands, and, in the early stages of its growth, obscurely ribbed: spire elevated, pointed: whorls

(8—10) slightly convex; the posterior margins narrow, very slightly depressed, rather thickened at the edges, and presenting round the suture two raised lines, obscurely granulated; in front of these, two or three fine, thread-like lines run along the middle part of the margin, granulated by the lines of growth, which are much elevated until they cross the shoulder, and give a wrinkled appearance to the margin. The spiral bands over the other parts of the whorls are numerous, irregular, and unequal; smaller ones alternating with large ones. The aperture is narrow, and of an oblong-oval form; the outer lip arched, and the sinus, which is moderately wide, and not very deep, is placed in the front part of the margin, immediately behind the shoulder.

In the ornamentation the present species resembles *P. helix*, but the narrow posterior margin, the position of the sinus, and the slight but nearly regular convexity of the whorls, giving a symmetrical appearance to the shell, distinguishes it as well from that species as from *P. crassa.*

*Size.*—The largest specimen figured would be, if perfect—axis, nearly 4 inches; diameter, 1 inch.

*Localities.*—Potter's Bar, Chalk Farm, Southampton, Shenfield.

### No. 137. PLEUROTOMA TERETRIUM. *F. E. Edwards.* Tab. XXV, fig. 8 *a—h.*

*P. testâ elongatâ, fusiformi, spiraliter lineatâ: anfractibus convexiusculis, marginibus posticis concavis, concentrice lineatis, ad suturam marginatis; suturis perspicuis; ultimo anfractu valde producto, in canali longo exeunti; lineis spiralibus irregularibus, alternatim funiculosis et tenuibus, lineis incrementi per-asperatis: aperturâ elongato-ovali; labro valde arcuato; sinu lato, profundo, in margine collocato.*

*Var.* NANODIS. *Testâ breviori, latiori; marginibus posticis anfractuum pauxillum cavatis.*

*Var.* CREBRILINEA. *Testâ minori, graciliori: anfractibus obsolete tuberculatis, lineis spiralibus numerosis, æqualibus, fortiter decussatis.*

*Var.* TUBERCULATA. *Testâ graciliori: anfractibus sub-angulatis, tuberculatis, ad suturam crenulatis: lineis spiralibus confertis, sub-æqualibus.*

*Var.* LATIMARGINATA. *Testâ minori: spirâ tuberculatâ: marginibus anfractuum latissimis, contrâ spiram expressis.*

Shell elongate, fusiform, ornamented with numerous spiral, raised lines; spire elevated, formed of 7—9 volutions: whorls somewhat convex, separated by a perspicuous suture, and much produced in front, the last whorl terminating in a long, nearly straight canal; the posterior margins concave, slightly thickened, and occasionally feebly crenulated at the edge. The spiral lines over the middle and front parts of the whorls are irregular, thickish, cord-like bands, alternating with slender, thread-like lines, and all much roughened, almost decussated, by the lines of growth; the spiral lines on the posterior margins are numerous and nearly equal, the two or three nearest the suture being rather more prominent than the others. The aperture is of a lengthened, ovate form; the outer lip much arched; and the sinus, which is placed in the front part of the marginal depression, is deep and moderately wide. Specimens frequently occur (var. *nanodis*, fig. 8 *b*) in which the shell is shorter and wider than in the typical form, and the margins of the whorls not being so much depressed and hollowed out, give a nearly conical form to the spire; but the character of the concentric lineation, the shape and position of the sinus, and the form of the outer lip, correspond with those of the type.

Other forms also occur which, although presenting differences in the proportions or ornamentation of the shells, or in the form of the outer lip, agree in other respects so closely with the present species, that they appear to me to be merely varieties of it.

In the first of these forms (var. *crebrilinea*, fig. 8 *f*), the shell is smaller and narrower, the spire more pointed and obscurely tuberculated; the spiral lines are slender, numerous, and deeply cut by the sharp, prominent lines of growth, and the margins of the whorls are finely plicated. In the next form (var. *tuberculata*, fig. 8 *c*—*e*) the spire is more slender; the concentric ornamentation resembles that of the variety *crebrilinea*, but the whorls are angulated, and present a single row of slightly oblique, oblong tubercles, which are continued, in some instances, even on the last whorl of the fully formed shell. The third variety (var. *latimarginata*, fig. 8 *g*, *h*) resembles the preceding variety in the proportions of the shell, and the angular and tuberculated whorls, but the posterior margins are widely spread out, and pressed against the preceding whorls, which are covered by them almost up to the tubercles. In all the last three varieties, the outer lip is not so much arched as that of the typical form.

This species so closely resembles one from Tortona (*P. granulosa*, Bon.; *P. Sismondæ*, Bell.), that it is difficult to separate the two. In the Italian shell, the whorls appear to be more numerous, and the posterior margins present from three to five rows of bead-like granulations near the suture; but, judging from the figure and description given by Bellardi, the two species appear to agree in the form of the whorls, the character of the spiral ornamentation, the condition of the outer lip, and the position and shape of the sinus. The differences pointed out are scarcely sufficient to justify the separation of the present species; but without an actual comparison of the shells themselves, I do not venture to identify a form from the older eocene deposits in this country with one from the pliocene formations of Italy.

*Size.*—Of the type; axis, 2 inches and a half; diameter, 10-12ths of an inch. Of the variety *tuberculata;* axis, 1 inch and 7-12ths; diameter, not quite half an inch.

*Localities.*—The species is found, in all its varieties, at Highgate; the variety *crebrilinea* also occurs at Potter's Bar and Shenfield; and the variety *tuberculata* at

Southampton, Shenfield, Clarendon Hill, Primrose Hill, Haverstock Hill, and Alum Bay (No. 4, Prestwich). In the variety *crebrilinea*, from Shenfield, the body-whorl is short, and rather suddenly contracted in front, and the lineation is very fine and nearly equal.

### No. 138. Pleurotoma crassa. *F. E. Edwards.* Tab. XXVI, fig. 1 *a—d.*

*P. testá elongato-fusiformi, longitudinaliter costulatá, spiraliter fasciatá; spirá elevatá, acuminatá: anfractibus convexis, antice subito coarctatis; marginibus posticis concavis, concentrice granuloso-lineatis, ad suturam incrassatis, oblique plicatis; suturis perspicuis; fasciis spiralibus numerosis, plus minusve latis, crassis, cum lineis concentricis filiformibus alternantibus, lineis incrementi per-asperatis: aperturá oblongo-ovali; labro leviter arcuato; sinu lato sub-triangulari in mediá margine collocato; canali antico, longo, recto.*

Shell elongate, fusiform, longitudinally ribbed, and spirally banded: spire elevated, being nearly as long as half the shell, and pointed: whorls many (9—11), convex, rather suddenly contracted, and much produced in front; the posterior margins hollowed out, thickened and strongly plicated by the prominent lines of growth on the sutural edge; the ribs rounded, moderately distant, rather oblique and short, not extending, even in young shells, much in front of the shoulder, and lost on the last whorl of the fully grown shell. Several coarsish concentric lines traverse the margins of the whorls, and are decussated by the lines of growth; two or three on the sutural edges are thicker and more elevated than the others, and from the deep decussation assume the appearance of a double row of coarse granulations: the bands over the middle and front of the whorls are more or less broad, prominent, rather closely set, and separated by strong, thread-like lines, the whole much roughened by the lines of growth: the body whorl is produced in front into a long, moderately wide, and nearly straight canal. The aperture is of an oblong, ovate shape; the outer lip arched, but not much; and the sinus, which is placed in the middle of the margin, is wide and subtrigonal. Occasionally specimens occur in which the shell is wider, and the spire not so much produced; but in all other respects agreeing with the typical form.

*Size.*—The large specimen figured would be, if perfect—axis, 4 inches and 3·12ths; diameter, 1 inch and 4-12ths.

*Localities.*—Clarendon Hill, Southampton, Shenfield.

### No. 139. Pleurotoma planetica. *F. E. Edwards.* Tab. XXVI, fig. 3.

*P. testá elongato-fusiformi, sub-turritá, undique spiraliter lineatá; spirá elevatá, acumi-*

*natâ: anfractibus numerosis, angulatis, convexis, sub-ventricosis, in juventâ tuberculatis; marginibus posticis latiusculis, concavis; ultimo anfractu in canali longo, recto, terminanti; striis spiralibus numerosis, inæqualibus, lineis incrementi asperatis; striis duobus vel tribus ad humeros prominentioribus: aperturâ pyriformi; labro arcuato; sinu lato, profundo, in margine collocato.*

Shell elongate, fusiform; spire much produced, pointed: whorls many (10—12), convex, somewhat ventricose, angulated at the shoulders, much attenuated, and produced in front, the last whorl terminating in a long, straight, moderately wide canal; the posterior margins are rather wide, depressed, channeled along the middle, and somewhat thickened at the edge, so as to present a broadish, slightly elevated border round the suture. The angulated shoulders, and depressed posterior margins of the whorls, give a turreted character to the spire. Two sharp, elevated, and rather distant spiral lines run round the border, and several faint and unequal lines traverse the hollow part of the margins. On the middle and front parts of the whorls the spiral lines are numerous, irregular, and unequal, a slender, thread-like line occasionally occurring between thicker and more elevated lines; two or three on the shoulder are more prominent and distant than the rest. The aperture is pear-shaped, rounded behind, contracted in front; the outer lip much arched; the sinus wide, very deep, sub-trigonal in form, and placed a little in front of the middle part of the margin.

This elegant Pleurotoma is apparently confined to the middle eocene strata; it has hitherto been obtained only from Bramshaw and the synchronous beds at Bracklesham Bay.

*Size.*—Axis, 2 inches and 9-12ths; diameter, 10-12ths of an inch.

### No. 140. Pleurotoma goniæa, *F. E. Edwards*. Tab. XXV, fig. 10.

Pleurotoma transversaria, *Sow.* (non *Lam.*) 1850. Dixon's Geol., &c., of Suss., p. 102.
— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 270.

*P. testâ elongato-fusiformi, turritâ, lineis spiralibus omnino tectâ; spirâ elevatâ: anfractibus depresso-convexis, angulatis, obscure carinatis; marginibus posticis latis, subconcavis, ad suturam crenulatis; ultimo anfractu in canali mediocri, subrecto, exeunti; lineis spiralibus tenuibus, confertis, irregularibus: aperturâ lanceolatâ; labro rotundo-arcuato; sinu mediocriter lato, profundo, in margine collocato.*

Shell elongated, fusiform, turreted; spire elevated, apparently much exceeding the last whorl in length: whorls rather convex, flattened at the sides, and angulated at the shoulders, which slightly project, and present the appearance of an obscure, rounded keel; the posterior margins are very wide, hollowed out, and crenulated round the suture; the last whorl contracts rather suddenly in front, and terminates in a widish, moderately long, and nearly straight canal. The whole surface of the shell is covered with very fine, spiral, raised lines, rather distant in front, crowded, unequal, and irregular over the middle part of the whorls, where very slender, thread-like lines frequently alternate with thicker and more prominent lines; three or four faint lines run along the middle of the posterior margin, and on each side of them are several others, rather stronger and decussated by the lines of growth. The aperture is lanceolate; the outer lip large, and roundly arched; and the sinus deep, moderately wide, and placed in the very middle of the collar: the columella is slightly twisted.

The shell figured forms part of my collection, and is the specimen which Mr. Sowerby (loc. cit.) has referred to *P. transversaria* (Lam.); but the long, turreted spire, the angulated whorls, the character of the transverse lineation, the shape of the outer lip, and especially the position of the labial sinus, seem to entitle it to specific distinction. The species is very rare.

*Size.*—If the specimen figured were perfect, the dimensions would be—axis, 2 inches and 4-12ths nearly; diameter, 10-12ths of an inch.

*Locality.*—Bracklesham Bay.

### No. 141. PLEUROTOMA TRANSVERSARIA, *Lamarck.* Tab. XXV, fig. 9 *a, b.*

PLEUROTOMA TRANSVERSARIA, *Lamk.* 1804. Ann. du Mus., vol. iii, p. 166, No. 6.
— — *Ib.* 1822. Hist. Nat., vol. vii, p. 98, No. 1.
— — *De Blainv.* 1826. Dict. des sc. nat., vol. xli, p. 389.
— — *Desh.* 1832. Encyc. méthod. (Vers.), vol. iii, p. 796, No. 14.
— — *Ib.* 1824-37. Descr. des coq. foss., &c., vol. ii, p. 450, t. 62, figs. 1, 2.
Nec PLEUROTOMA TRANSVERSARIA, *Grat.* 1838. Tabl. stat. des. coq., &c., de l'Adour, p. 13, No. 152.
nec — — *Ib.* 1838. Cat. zool., &c., de la Gironde, p. 45, No. 382.
nec — — *Ib.* 1847. Conchyl. foss., &c., de l'Adour, supp. Pleurot., t. 1, fig. 11, No. 19.
nec — — *Sow.* 1850. Dixon's Geol., &c., of Sussex, p. 102.

*P. testâ elongato-fusiformi, spirâ acuminatâ: anfractibus convexiusculis, postice et antice tenuissime lineatis, cæterum levibus; marginibus posticis depressis, sub-canaliculatis; ultimo anfractu in canali longo, angusto, exeunti: aperturâ ovatâ; labro tenuissimo, arcuato; sinu mediocriter lato, profundo, in margine collocato.*

*Var.* CYPHA (fig. 9 *b*). *Testâ minori; anfractibus convexis; marginibus posticis depressioribus.*

Shell fusiform, elongated, with an elevated, nearly conical spire: whorls (10—11) slightly convex, and depressed, almost channeled, on the posterior margins; the space between the suture and the shoulder is covered with numerous, very fine, spiral, raised lines, which, in well-preserved specimens, are decussated by the lines of growth; the middle part of the whorl in the adult shell is quite smooth, and the body-whorl, which is rather longer than the spire, terminates in a long, narrow, nearly straight canal, ornamented with numerous, somewhat irregular, obliquely transverse, raised lines; these lines, which are very fine and undulating, gradually become more and more feeble as they ascend the canal, and ultimately disappear towards the middle of the whorl. The aperture is ovately oblong; the right lip very thin, and much arched; the sinus, which is placed in the margin, just behind the shoulder, is wide and moderately deep.

In the specimens from Lyndhurst (var. *cypha*), the whorls are more convex, the posterior margins more depressed, and the outer lip less roundly arched than in the typical form, and the shells themselves are smaller; but in the ornamentation, and in the position and shape of the labial sinus, they agree with *P. transversaria*, of which they appear to be merely local varieties.

The shells from Dax and the environs of Bordeaux, described by Grateloup, and to which M. Deshayes refers as being possibly a variety of the Paris basin species, are specifically distinct, and have been named *P. opis* by M. D'Orbigny; and the specimen from Bracklesham Bay which Mr. Sowerby (Dixon's 'Geol.,' &c.) has referred to the present species, also appears to be specifically distinct, and I have separated it accordingly under the name *P. goniæa*.

Our English specimens have attained a less size, and are somewhat narrower, than the French ones, but in all other respects they agree well.

*Size.*—Axis, 1 inch and 10-12ths; diameter, rather more than 7-12ths of an inch.

*Localities.*—Brockenhurst, Lyndhurst. *French*—Parnes, Grignon, Chaumont (fide *D'Orb.*); Marquemont, Lattainville, Hermes, Neuvillebose, Saint-Felix (fide *Graves*); Betz, department de l'Oise (fide *De Blain.*)

### No. 142. Pleurotoma cymæa, *F. E. Edwards.* Tab. XXVI, fig. 4 *a*, *b*. Tab. XXVII, fig. 9.

*P. testâ elongato-fusiformi, latiusculâ, tuberculatâ, undique spiraliter lineatâ; spirâ elevatâ, sub-conicâ: anfractibus convexis, angulatis; marginibus posticis latis, vix cavatis; tuberculis numerosis, parvis, nodiformibus, obliquis; lineis spiralibus confertis, subtilissimis, undulosis, antice eminentioribus, postice fere obsoletis: aperturâ oblongo-ovali, in canali longo, recto, exeunti; labro arcuato, tenui; sinu profundo, in margine collocato.*

*Var.* NANA. *Testâ minori, angustiori: canali longiori?*

Shell rather broad, fusiform, with an elevated, nearly conical spire, formed of nine or ten volutions: whorls convex, sharply angulated at the shoulders, where they present a row of numerous, obliquely compressed, small, knob-like tubercles. The whole surface of the whorls is covered with very fine, slightly undulating, closely set, thread-like, concentric raised lines, irregular, unequal, and roughened by the lines of growth; these lines are prominent on the canal and the front part of the shell, but become more and more faint, and at last are almost effaced as they approach the shoulders of the whorls. The posterior margins are wide, very slightly channeled along the middle, and ornamented with numerous slender, concentric lines, four or five of which, running along the sutural edge, are more prominent than the rest, and are decussated by the oblique lines of growth of the sinus, forming a riband-like border to the whorls. The aperture is of an oblong, oval form, and terminates in front in a long, straight canal; the outer lip is thin, sharp-edged, and much arched; the sinus is deep, not very wide, and placed a little in front of the middle of the collar.

In the variety *nana* (Tab. XXVII, fig. 9), which is proposed for an immature specimen from Colwell Bay, in my collection, the shell is much smaller and narrower, and, apparently, the canal is more produced; but on this last point I cannot speak with certainty, as the canal is not perfect in any of the specimens of the type I have seen. In the general form of the shell, however, in the nearly conical spire, the character of the ornamentation, the position and shape of the sinus, and the roundedly arched outer lip, the specimen in question agrees so exactly with the true *P. cymæa*, that I can only regard it as a variety of that species dwarfed by unfavorable conditions.

This Pleurotoma, which at first sight might be considered to be a local variety of *P. dentata*, is distinguishable from that species by the greater width of the shell, the more conical spire, the wider posterior margins of the whorls, the character of the transverse ornamentation, and the numerous small, knob-like tubercles which take the place of the sharp-edged transverse teeth, characteristic of *P. dentata*. It more resembles *P. transversaria*, as well in the shape and relative proportions of the shell, as in the form and position of the sinus and the character of the concentric lineation; and a larger series of specimens may eventually lead to the conclusion that it is merely a variety of that species. The tuberculated and sharply angulated whorls, however, characters to which I am not aware that *P. transversaria* offers any approach, apparently entitle the shells in question to specific distinction.

*Size.*—Axis, 1 inch and 4-12ths; diameter, ½ inch.

*Locality.*—Brockenhurst and Colwell Bay, at each of which places it appears to be very rare.

### No. 143. PLEUROTOMA COCCIPHORA, *F. E. Edwards.* Tab. XXVI, fig. 2.

*P. testâ elongatâ, fusiformi, longitudinaliter costellatâ, undique spiraliter granuloso-lineatis · anfractibus convexiusculis, angulatis, ad suturas incrassatis, granulatis; marginibus posticis mediocriter latis, vix cavatis, lineas filiformes confertas gerentibus; costellis angustis; lineis spiralibus numerosis, fortiter decussatis, inæqualibus, lineis majoribus cum lineis tenuibus alternantibus: aperturâ ovali; labro leviter arcuato; sinu fere semicirculari, in margine collocato.*

Shell elongate, fusiform, longitudinally ribbed, and having the whole surface ornamented with spiral raised lines; spire elevated, pointed: whorls (7—9) slightly convex, angulated; the posterior margins moderately wide, nearly straight, and covered with fine, thread-like, concentric lines; two on the sutural edge are more prominent than the others, and decussated by the lines of growth so as to present a double row of fine granulations; the last whorl is produced in front into a long, and apparently nearly straight, and moderately wide canal; the costellæ are narrow, rather short, barely extending beyond the middle of the whorl, and are more or less distant in different specimens; the spiral lines over the middle and front parts of the shells are numerous and unequal, a slender, thread-like line occasionally intervening between others thicker and more prominent; all are deeply and regularly decussated by the lines of growth, so that the larger lines assume the appearance of rows of bead-like knobs. The aperture is of an oblong, oval shape; the outer lip slightly arched; and the sinus, which is placed towards the front of the margin, is wide, not very deep, and almost semicircular.

This Pleurotoma closely resembles the young shell of *P. crassa,* of which, if it were not for the great difference in size, it might be considered to be only a local variety; the spire, however, is shorter and more conical, the whorls more angulated, less convex and more gradually attenuated in front; the posterior margins narrower and less concave; and the sinus nearer the shoulder, and rounder than in that species. The spiral lines also, broken into rows of beads by the lines of growth, form an ornamentation quite distinct in character from the broad, coarse bands which characterise *P. crassa.*

The specimen figured forms part of Mr. Wetherell's collection.

*Size.*—Axis, rather more than 1 inch; diameter, 4-12ths of an inch.

*Locality.*—Highgate, where it is apparently very rare.

## No. 144. Pleurotoma rostrata, *Solander*. Tab XXVI, fig. 8 *a—c*.

Murex rostratus, *Sol.* 1766. Brand., Foss. Hanton., p. 21, t. 2, fig. 24.
Pleurotoma rostrata, *Sow.* 1818. Min. Con., vol. ii, p. 104, t. 146, fig. 3.
— — *De Bl.* 1826. Dict. des. sci. nat., vol. xli, p. 390.
— — *Morris.* 1842. Cat. Brit. Foss., p. 157.
— sub-rostrata, *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 359, No. 406.
— rostrata? *Phil.* 1851. Tert. Foss. Magdeb. (Palæont., vol. i, p. 64), No. 118.
— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 270.
Nec Pleurotoma rostrata, *De Kon.* 1837. Desc. des. coq. foss., &c., de Basele, Boom, &c., p. 24, No. 23.
nec — — *Nyst.* 1843. Desc. des. coq. foss., &c., de la Belg., p. 522, t. 42, figs. 2, 3.
nec — — *Ib.* 1843. Bull. Soc. Géol. de France, vol. xiv, p. 453.

*P. testâ elongato-fusiformi, angustâ, turritâ, undique spiraliter lineatâ; spirâ elevatâ, acuminatâ: anfractibus numerosis, convexis, in medio oblique tuberculatis; marginibus posticis concavis, ad suturam aliquando paulum incrassatis et cingulo duplici crenulato cinctis, aliquando simplicibus; lineis spiralibus in margine tenuibus, cæteris elevatis, rotundatis, irregularibus, inæqualibus, lineis incrementi per-asperatis: aperturâ oblongo-ovali, in canali prælongo, angustato, subrecto productâ; labro aliformi; sinu profundo mediocriter lato, in margine collocato.*

*Var.* ANTIQUA. *Testâ latiori, breviori; anfractibus subangulatis.*

Shell long, narrow, fusiform, turreted, having the whole surface covered with spiral raised lines; the spire much elevated, being nearly half the length of the whole shell, and pointed; the whorls are numerous (10—12 without the pullus), very convex, and armed near the middle with a single row of oblique tubercles, more or less prominent in different individuals; the posterior margins are moderately wide, concave, occasionally thin, and nearly smooth along the sutural edge, but more frequently slightly thickened, plicated, and ornamented with two prominent concentric lines, granulated by the lines of growth. The spiral lines in the middle of the posterior margin are close-set and very slender; over the other parts of the whorl they are prominent, rounded, irregular, unequal, small filiform lines intervening between larger ones; and all are very much roughened, almost granulated, by the lines of growth. The aperture is of an oblong, ovate form, and terminates in front in a long, rather narrow, and somewhat curved canal; the outer lip is roundedly arched and wing-like; the sinus is deep, moderately wide, subtrigonal, and placed in the middle of the margin.

In the specimens from Highcliff (var. *antiqua*, fig. 8 *c*), the shells are wider, and proportionately shorter than in the type, and the whorls are slightly angulated at the shoulders.

Much confusion exists among several of the Continental authors with respect to this species, in consequence of the shell figured as *P. rostrata* in 'Mineral Conchology' having been considered by them as distinct from the *Murex rostratus* of Solander, although Mr. Sowerby cites the latter as a synonym. Thus M. de Koninck has described a pleurotoma from Basele and Boom, which he has referred to *P. rostrata* of Sowerby, but without having cited Brander's figure; and this pleurotoma, Nyst, after stating that it differs essentially from *Murex rostratus*, but that it is without doubt Sowerby's *P. rostrata*, regards as merely a variety of *P. Selysii* (De Kon.), to which latter species he refers it. The same author subsequently describes another species, from Basele, Boom, &c., as identical with Brander's shell, but he excludes *P. rostrata* of Sowerby. The description given by M. de Koninck agrees tolerably well with the present species; but, assuming that the shells described by that author belong, in fact, to the same species as those represented by Nyst (*P. Selysii*, t. 40, fig. 11 and *P. rostrata*, t. 42, figs. 2, 3), I do not think that any one familiar with the English shells can regard either of them as identical with the species figured by Brander, and described by Sowerby. Philippi has recorded a single specimen from Görzig, in the Museum at Halle, which he has referred to the present species. This author, however, has not given either figure or description, and as, under the circumstances to which I have referred, the accuracy of this identification cannot be assumed, I have cited Philippi with a query. At present there appears to be every reason for believing that the true *P. rostrata* of Solander is confined to the upper beds of the middle eocene formations of England; and, although Mr. Morris gives Highgate and Sheppey as localities, I am not aware of its occurrence at either of those places, nor even at Bracklesham Bay, which is also given as a locality by the same author.

*Size.*—Axis, rather more than 4½ inches; diameter, not quite 1 inch.

*Localities.*—Barton, Alum Bay (No. 29, Prestwich), and Highcliff.

### No. 145. PLEUROTOMA KEELEI, *F. E. Edwards*. Tab. XXVI, fig. 6.

*P. testâ fusiformi, turritâ, tuberculatâ spiraliter fasciatâ; spirâ elevatâ, acuminatâ: anfractibus convexis, ad humeros angulatis, unicâ serie tuberculorum spiniformium munitis; marginibus posticis latis, concavis, concentrice lineatis, ad suturas crenulatis; ultimo anfractu turbinato, in canali longo exeunti; fasciis spiralibus, irregularibus, inæqualibus, fasciis crassis cum aliis tenuibus alternantibus: aperturâ oblongo-ovali; labro valde arcuato, sinu mediocriter lato profundo, in margine collocato.*

Shell fusiform, turreted, tuberculated, spirally banded; the spire much elevated, pointed, formed of nine or ten volutions: whorls angulated at the shoulders, and armed with a single row of large, pointed, rather distant tubercles; the posterior margins wide, concave, thickened and obliquely plicated at the suture, and ornamented with several fine concentric raised lines; of these, two running round the border are more elevated than the rest, and are decussated and feebly granulated by the plication on the edge, and two others, running along the hollow part of the margin, are also rather prominent and granulated by the lines of growth. The last whorl is somewhat turbinate, and terminates in front in a long, moderately wide, straight canal. The bands on the middle and front surfaces of the whorls are numerous, coarse, irregular, and very unequal, and much roughened by the lines of growth; three or four over the middle part of the whorls are thicker and more prominent than the rest, and between them appear two or three smaller unequal bands. The aperture is of an oblong, ovate form; the outer lip much arched; the sinus deep, moderately wide, sub-trigonal, and placed in the very middle of the margin.

This beautiful and well-marked species was first obtained from the Artesian well at Southampton, by Mr. Keele, to whom I have ventured to dedicate it.

*Size.*—Axis, 3 inches and 3-12ths; diameter, 1 inch and 1-12th.

*Localities.*—Southampton and Shenfield.

### No. 146. Pleurotoma dentata, *Lamarck*. Tab. XXVI, fig. 5.

Pleurotoma dentata, *Lamk.* 1804. Ann. du Mus., vol. iii, p. 167, No. 8; vol. vii, t. 13, fig. 1.
— — *Ib.* 1822. Hist. nat., vol. vii, p. 99, No. 13.
— — *De Bl.* 1826. Dict. des sci. nat., vol. xli, p. 395.
— costulifera? *Bronn.* 1827. Zeitschrift für Mineral., band ii, p. 535, No. 120.
— dentata, *Ib.* 1831. Italiens tertiärgeb., p. 46, No. 222.
— — *Desh.* 1832. Enc. méth. (Vers), vol. iii, p. 797, t. 440, fig. 8, No. 16.
— *Ib.* 1824–37. Descr. des coq. foss., &c., vol. ii, p. 452, t. 62, figs. 3, 4, 7, 8.
— — *Morris.* 1843. Cat. Brit. Foss., p. 157.
— — *Sow.* 1850. Dixon's Geol., &c., of Sussex, p. 102, t. 6, fig. 24.
— — *Rouault.* 1848. Desc. des foss., &c., de Pau (Mém. de la Soc. Gèol. de France, 2d series, vol. iii, p. 484), No. 92, t. 16, fig. 24.
— — *D'Orb.* 1853. Prod. de Paléont., vol. ii, p. 358, No. 382.
— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 270.

*P. testâ elongatâ, fusiformi, undique concentrice lineatâ; spirâ elevatâ, acuminatâ: anfractibus convexiusculis, angulatis, dentato-tuberculatis; marginibus posticis mediocriter latis, vix cavatis, ad suturas pauxillum incrassatis; ultimo anfractu in canali longo termi-*

*nanti; striis concentricis confertis, irregularibus, in marginibus posticis tenuissimis; cæteris, striis eminentioribus cum aliis tenuibus alternantibus: apertura angusto-ovali; labro arcuato, tenui; sinu lato, sub-trigono, in margine collocato; canali subrecto, antice reflexo, emarginato.*

Shell elongated, fusiform, having the whole surface ornamented with concentric raised lines; the spire much elevated, being nearly as long as the body-whorl, pointed, and formed of ten or eleven volutions. The whorls are rather convex, sharply angulated at the shoulders, and armed with a row of transversely compressed, tooth-like tubercles, rounded in front, sharp, sometimes almost carinated at the edges, varying both in number and prominence in different individuals, and occasionally having their bases prolonged into short, rounded costellæ; the posterior margins are moderately wide, straight, or but very slightly hollowed out, and a little thickened at the sutural edges, where they are sometimes obliquely plicated by the lines of growth of the sinus; the surface between the suture and the shoulder is covered with very fine, almost obsolete, concentric lines, two of which, running round the sutural edge, are more elevated than the rest; the middle and front parts of the whorls are ornamented with numerous, irregular, undulating, thread-like, raised lines; of these some are prominent, and between them appear two or three others very slender, so much so, in fact, as to be barely perceptible by the naked eye. The aperture is of a narrow, ovate form, and terminates in a long, moderately wide, and nearly straight canal, bent backwards, and notched at the anterior extremity; the outer lip is thin, sharp-edged, and slightly arched; the sinus wide, rather deep, sub-trigonal in form, and placed in the very middle of the margin; the anterior extremity of the columella presents a prominent ridge or crest, formed by the notch of the canal.

This species is very common and widely distributed in the French formations; in England it is, apparently, confined to the middle beds of the Bracklesham Bay series. Our specimens are narrower than the French type; and in this respect and in the character of the transverse ornamentation they agree with the variety *a* of Deshayes; I have not met with the other variety recorded by that author, nor do our shells appear to have attained the size of those from the French beds. D'Orbigny, (loc. cit.) gives Claiborne, in Alabama (U.S.), as a locality. I cannot but think, however, that this identification is somewhat questionable. The present species is the type of a group of closely analogous forms, and two English species (*P. exorta* and *P. macilenta*, Sol.), which, as will be afterwards shown, are perfectly distinct, have in fact been confounded with it. No authority is cited by the author, and I have therefore given Claiborne as a questionable locality.

*Size.*—Axis, 1 inch and 7-12ths (40 millim.); diameter, not quite 7-12ths of an inch (15 millim., nearly).

*Localities.*—Bracklesham Bay; Bramshaw. *French*—Grignon, Parnes, Mouchy, Courtagnon, &c., La Chapelle près Senlis, Valmondois (fide *Desh.*), Cuise-Lamotte, Acy-en-Mulcien, Fosse-Martin, Ermenonville, Ver (fide *Graves*), Laon (fide *Mellev.*), Bos d'Arros (fide *Rouault*). *North American*—Claiborne, Alabama (fide *d'Orb.*)?

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### No. 147. PLEUROTOMA TEXTILIOSA, *Deshayes*. Tab. XXVI, fig. 7.

PLEUROTOMA TEXTILIOSA, *Desh.* 1824-37. Desc. des coq. foss., &c., vol. ii, p. 454, t. 62, figs. 5, 6.
— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 417, No. 1480.

*P. testá elongato-fusiformi, angustá, sub-turritá, longitudinaliter costatá, spiraliter subtilissime lineatá; spirá elevatá, acuminatá: anfractibus sub-convexis, angulatis; marginibus posticis angustis, concavis, ad suturam incrassatis; costis distantibus, obtusis; lineis spiralibus confertis, inæqualibus, lineis incrementi sub-decussatis: aperturá ovato-angustá, in canali mediocri exeunti; labro acuto; sinu lato, trigono, in margine collocato.*

Shell elongate, fusiform, narrow, longitudinally ribbed and ornamented with numerous, very fine, concentric, raised lines; the spire, which is formed of eight or nine volutions exclusive of the pullus, is pointed and much produced, fully equalling the last whorl in length: the whorls are slightly convex, and angulated at the shoulders; the posterior margins narrow, hollowed out, and thickened at the edges so as to form an elevated border round the suture; the whole of the margin is covered with very fine, regular, closely set, concentric lines, of which those on the border are more conspicuous than the rest. The longitudinal ribs are rather distant, round, thick, and short, barely extending to the middle of the whorls, and terminating abruptly at the shoulders, where they present a sharp keel-like edge, which gives somewhat of a turreted aspect to the spire. The concentric lines over the front and middle parts of the whorls are very numerous, unequal, and irregular; some of them, slender and thread-like, are prominent and more or less distant, and the intermediate spaces are covered with exceedingly fine lines, scarcely perceptible by the naked eye; the whole are roughened by the lines of growth. The aperture is of a narrow, ovate form, and terminates in front in a moderately long canal, slightly notched at the anterior extremity; the outer lip is thin, sharp-edged, and expanded behind; the sinus which is wide, deep, and somewhat trigonal in form, is placed a little in front of the middle part of the posterior margin of the whorl; the columella is slightly twisted and presents a conspicuous but not very prominent crest. M. Deshayes states that the columella is "sub-perforated at the base," presenting there a narrow, shallow "umbilical opening, partly covered by the inner lip;" this opening, however, is not truly umbilical, but a slight hollow caused by the ridge or crest being imperfectly overlapped by the inner lip, and is a character very variable, and sometimes wanting.

The present species is an intermediate form between *P. crassicosta* and *P. dentata;* but the thick, rounded, distant ribs, the crowded transverse ornamentation, and the broader and shorter canal, render it easily distinguishable.

*Size.*—Axis, 1 inch and 5-12ths nearly (35 millem.); diameter, half an inch (13 millem.). The French shells attained a somewhat larger size.

*Localities.*—Bracklesham Bay; Bramshaw. *French*—Monneville (fide *Desh.*), Aumont, Acy-en-Mulcien (fide *D'Orb.*). It is very rare in England, but, apparently, common in the French beds.

## No. 148. PLEUROTOMA EXORTA, *Solander*. Tab. XXVI, fig. 12 *a*, *b*.

MUREX EXORTUS, *Sol.* 1766. Brand., Foss. Hanton., p. 20, fig. 32.
PLEUROTOMA EXORTA, *Sow.* 1816. Min. Conchol., vol. ii, p. 104, t. 146, fig. 2.
— — *Morris.* 1843. Cat. Brit. Foss., p. 157.
— — *Sow.* 1850. Dixon's Geol., &c., of Sussex, p. 102.
— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 359, No. 408.
Nec PLEUROTOMA EXORTA, *Nyst.* 1835. Recher. sur les coq. foss., &c., d'Anvers, p. 28, No. 27.
nec — — *De Kon.* 1837. Descr. des coq. foss., &c., de Basele, Boom, &c., p. 22, No. 21.
nec — — *D'Orb.* 1850. Prod. de Paléont., vol. iii, p. 13, No. 195 m.

*P. testâ elongato-fusiformi, turritâ, undique spiraliter lineatâ: spirâ elevatâ, subconicâ, nodulosâ: anfractibus convexis, prioribus obscure costellatis; ultimo anfractu subconico scilicet sensim attenuato, in canali longiusculo exeunti; marginibus posticis declivis, cavatis, ad suturam incrassatis, transversim exilissime lineatis; striis spiralibus nonnullis remotiusculis, eminentioribus, acutis; cæteris subtilissimis æqualibus: aperturâ lanceolatâ; labro valde arcuato, tenui; sinu lato, in margine collocato.*

Shell elongated, fusiform, turreted, ornamented with spiral raised lines; the spire elevated and terminating in a small pointed pullus formed of two or three smooth volutions: whorls convex, the earlier ones very broadly and obscurely ribbed, giving a nodulous aspect to the spire; the posterior margins are somewhat thickened on the sutural edge, and but slightly depressed, so that the spire presents a nearly conical form; the space between the suture and the shoulder is channeled and covered with very fine and regular concentric lines, so slender as scarcely to be visible by the naked eye or to detract from the smoothness of the surface. On the middle and front parts of the whorls, some of the spiral lines, rather distant from each other, are sharp and elevated; the rest, which cover the intermediate spaces, are very fine, close-set, and regular, although somewhat unequally prominent. The aperture is lanceolate, and terminates in a moderately long canal, gradually diminishing in width, and thus assuming the sub-conical form described by Solander as the chief distinction between *P. exorta* and *P. macilenta*. The outer lip is thin and much arched; and the sinus, which is wide and sub-trigonal, is placed in the very middle of the margin.

The elevated transverse line on the shoulders of the whorls, broken by the undulations caused by the ribs, occasionally presents a resemblance to the denticulation characteristic of *P. dentata;* and this circumstance probably led to *P. exorta* being considered as identical with *P. dentata*. The two species are, however, distinct; in this the shell is wider and shorter, the spire thicker and more conical, the whorls not so much angulated, the posterior margins narrower and less depressed, and the anterior canal shorter and more conical.

Nyst, in his 'Recherches sur les coquilles fossiles de la province d'Anvers,' has recorded certain shells from Boom which he has referred to the present species, and for which he has given Sowerby's diagnosis verbatim. Subsequently, De Koninck, in his 'Coquilles fossiles de Basele, Boom, &c.,' described some shells from those localities under the name *P. regularis,* and other shells he referred to the present species. These different shells, Nyst, in his later work, 'Description des coquilles, &c., de la Belgique," considered to be merely individuals of the same species in different stages of growth, and that author referred them, erroneously as I have already shown, to *P. rostrata* (Sol.) Unfortunately I have not any specimens of the Belgian species to refer to; but, assuming that De Koninck's *P. exorta* is but the young shell of his *P. regularis,* and judging from the figures given by him of the latter species and from those given by Nyst of the so-called *P. rostrata,* it is impossible to accept the identification of the Belgian shells with the present species as correct; a conclusion at which D'Orbigny has apparently also arrived, as that author has placed *P. rostrata* (Nyst) and *P. regularis* (De Kon.) in his "26th étage," under the specific name *P. exorta* (Nyst), in forgetfulness, probably, of that name having been previously used by Solander.

*Size.*—Axis, 1 inch and 1-12th; diameter, 5-12ths of an inch.

*Localities.*—Barton, Alum Bay (No. 29, Prestwich), Highcliff, Bracklesham Bay.

## No. 149. PLEUROTOMA MACILENTA, *Solander*. Tab. XXVI, fig. 13 *a*, *b*.

MUREX MACILENTUS, *Sol.* 1766. Brand., Foss. Hanton., p. 30, fig. 33.

*P. testâ elongato-fusiformi, angustâ, turritâ, undique spiraliter lineatâ, longitudinaliter costatâ: spirâ elevatâ, acuminatâ: anfractibus convexiusculis, angulatis; marginibus posticis concavis, ad suturam paulum incrassatis, transversim subtilissime lineatis; lineis spiralibus numerosis, inæqualibus, quibusdam filiformibus prætenuibus, inter alias eminentiores, acutas apparentibus; costis numerosis, angustis, obliquis, fere ad caudam tendentibus: aperturâ* *oblongo-ovali, in canali longo, angusto exeunti; labro leviter arcuato; sinu lato, in margine collocato.*

Shell long, narrow, fusiform, turreted, longitudinally ribbed, and concentrically lined: the spire, consisting of nine or ten volutions, is pointed, elevated, forming nearly a half of the length of the whole shell. The whorls are slightly convex and angulated at the shoulders; the posterior margins concave, slightly thickened round the suture, and covered with fine, thread-like, concentric lines, one or two of which near the edge are stronger and more prominent than the rest. The spiral lines over the middle and front parts of the whorls are numerous, irregular, unequal; some, more or less distant from each other, are prominent and sharp, and the intermediate spaces are occupied by two or three, occasionally by four, very slender and regular lines; the longitudinal ribs, which are rather numerous, narrow, and oblique, reach almost to the anterior canal. The aperture is oblong and ovate, and terminates in a moderately long, straight, and narrow canal; the outer lip is thin and slightly arched; the sinus wide, semi-circular in shape, and placed in the middle of the margin.

The present species, distinguished by its long costated spire, appears to be peculiar to the English middle eocene strata; Defrance, it is true, refers to it, although with doubt, as a synonym of *P. dentata*, but a slight comparison of the shells will prevent the two species being confounded. It presents closer resemblances as well to *P. textiliosa*, as to *P. crassi-costa;* from both of these species, however, notwithstanding the similarity in the ornamentation, it may be easily distinguished by the slenderer and more numerous ribs, and the longer and narrower anterior canal.

*Size.*—The dimensions of my largest specimen are—axis, 1 inch and 4-12ths; diameter, 5-12ths of an inch. Those of Brander's specimen, although represented in the figure given by him as considerably larger, are, in fact, very nearly the same.

*Localities.*—Barton, Alum Bay (No. 29, Prestwich), Highcliff, Bracklesham Bay.

### No. 150. PLEUROTOMA CRASSI-COSTA, *F. E. Edwards.* Tab. XXVI, fig. 10 *a*, *b*.

*P. testâ elongato-fusiformi, angustâ, turritâ, costatâ, undique spiraliter lineatâ; spirâ elevatâ; anfractibus convexiusculis, angustatis; marginibus posticis latiusculis, concavis, tenuissime lineatis, ad suturam incrassatis, cingulo duplici ornatis; ultimo anfractu parvo, repente coarctato, in canali lato, longo, subrecto exeunti; costis distantibus, brevibus, crassis: lineis spiralibus confertis, inæqualibus, nonnullis eminentioribus fortibus, cæteris exilibus: aperturâ oblongo-ovatâ; labro leviter arcuato; sinu lato, fere semicirculari, in margine collocato.*

Shell long, narrow, fusiform, turreted, ribbed, and having the whole surface ornamented with concentric lines: the spire, formed of eight or nine volutions exclusive of the pullus, is moderately elevated and pointed; whorls slightly convex, sharply angulated at the shoulder; the posterior margins rather wide, hollowed out, and thickened on the sutural edge, which is bordered by two or three prominent, raised lines; the remaining surface of the margin is covered with very fine, close-set, concentric lines; the last whorl is small, and terminates in a wide and long canal, a little curved near the anterior extremity. The ribs are distant, rounded, short, not extending to the middle of the whorl, prolonged over the posterior margins almost to the suture, and bearing at the shoulders of the whorls a row of transverse tooth-shaped tubercles. The spiral lines over the middle and front parts of the whorls are numerous and unequal; some, at nearly regular and not very distant intervals, are rather thick and prominent, and between these appear two or three slender, thread-like lines. The aperture is ovate, the outer lip moderately arched, and the sinus, which is placed in the middle of the margin, is wide but not deep.

The *P. crassi-costa* bears a close resemblance to *P. dentata,* of which, perhaps, it may prove to be merely a local variety. It presents, however, certain peculiarities of form which appear to me sufficient to justify the separation. Thus the shell is narrower, the spire relatively more produced; the posterior margins of the whorls are not so wide, the whorls themselves smaller and more suddenly contracted in front, and the longitudinal ribs thicker and more distant. From *P. textiliosa* it is distinguishable by the character of the transverse ornamentation, and the thick, rounded, and more distant ribs of that species. It approaches very nearly to a species from the sables moyens, at Senlis, at present unpublished, but which M. Deshayes purposes to describe under the name *P. Michelini,* in his forthcoming appendix; without a comparison, however, with a better series of specimens of that species than I possess, I do not venture to pronounce on the identity. Should the English and French shells prove, eventually, to belong to the same species, the name proposed by M. Deshayes will be entitled to priority.

*Size.*—Axis, 1½ inch; diameter, not quite half an inch.

*Locality.*—Bramshaw.

### No. 151. PLEUROTOMA LANCEOLATA, *F. E. Edwards.* Tab. XXVI, fig. 11 *a, b.*

*P. testâ elongatâ, angustâ, fusiformi, spiraliter lineatâ: spirâ elevatâ, sub-conicâ, tuberculatâ: anfractibus convexiusculis; marginibus posticis mediocriter latis, pauxillum declivis, vix cavatis, transversim exilissime lineatis; ultimo anfractu antice gradatim attenuato, in canali longo exeunti: aperturâ lanceolatâ; labro valde arcuato; sinu lato sub-trigono, in margine collocato.*

Shell long, very narrow, fusiform, ornamented with spiral, raised lines: the spire elevated, nearly conical, and terminating in a small, smooth, pointed pullus of two volutions: the whorls, 9—11 in number, are but slightly convex, and in the young state are tuberculated, or roundedly costellated; the posterior margins are moderately wide, very little depressed, nearly straight, and almost smooth, or ornamented with concentric lines, so faint and slender as to be almost imperceptible without the aid of a magnifying glass; the last whorl is produced in front, and, diminishing very gradually, terminates in a long, nearly straight canal. The aperture is lanceolate; the outer lip thin, sharp edged, and much arched; and the sinus, which is very wide, and sub-trigonal in shape, is placed a little in front of the middle part of the margin.

The long, narrow, lanceolate form, and nearly conical spire of this Pleurotoma distinguish it from all its congeners.

*Size.*—Axis, 1 inch and 4-12ths; diameter, 4-12ths of an inch.

*Localities.*—Barton and Alum Bay (No. 29, Prestwich), where it is not very common.

### No. 152. PLEUROTOMA LÆVIGATA, *Sowerby*. Tab. XXVI, fig. 9 *a*, *b*.

PLEUROTOMA LÆVIGATA, *Sow.* 1823. Min. Con., vol. iv, p. 120, t. 387, fig. 3.
— — *Morris.* 1843. Cat. Brit. Foss., p. 157.
— — *D'Orb.* 1850. Prod. de Paléont., vol. ii, p. 359, No. 412.
Nec PLEUROTOMA LÆVIGATUM, *Phil.* 1836. Enum. Moll. Sic., vol. i, p. 199, t. 11, fig. 17.
nec — LÆVIGATA, *De Kon.* 1837. Coq. foss. de Basele, &c., p. 27, No. 27, t. 1, fig. 5.
nec — — *Mellev.* 1843. Mém. sur les sables infér., &c., de Paris, p. 63, t. 8, figs. 9—11.

*P. testâ elongato-fusiformi, angustâ, turritâ, transversim tenuissime lineatâ: spirâ elevatâ, acuminatâ: anfractibus convexis, antice subito coarctatis, prioribus oblique costellatis; marginibus posticis angustis, depressis, sub-canaliculatis, lævibus; ultimo anfractu in canali longo, angusto, terminanti: aperturâ oblongâ, ovatâ; labro valde arcuato, tenui; sinu lato, fere semicirculari, in margine collocato.*

Shell long, narrow, fusiform, turreted, costellated, and spirally lined: the spire elevated, pointed, terminating in a pullus of two round, smooth volutions; whorls convex, rounded on the shoulders, contracted rather suddenly in front; the posterior margins narrow, depressed, slightly hollowed out, having the sutural edges thin and quite simple, and the surface smooth, almost polished, presenting only very feeble lines of growth of the sinus. The ribs are distant, rounded, oblique, and extend almost to the front part of the whorl in the young shell, but become shorter and less prominent as the shell enlarges, and altogether disappear on the body-whorl of the fully formed shell; the spiral lines are very slender, sharp, but little elevated, irregular, unequal, and decussated by the lines of growth. The aperture is of an oblong, ovate form, and terminates in front in a long, narrow, and slightly curved canal; the outer lip is much arched, and the sinus, which is wide and almost semicircular in shape, occupies the whole width of the margin.

Specimens occasionally occur in which the transverse lineation is nearly obliterated, and the whorls present a smooth, almost a polished, surface. The individuals figured by Mr. Sowerby were apparently in this condition; this smoothness, from which the specific name was taken, is, however, only an exceptional character.

The present species presents some analogy with *P. macilenta;* but the shell is narrower, the whorls more convex, more rounded on the shoulder, and more contracted in front; the canal is narrower, the outer lip more arched, and the sinus wider.

*Size.*—Axis, 1 inch and 3-12ths; diameter, rather more than 4-12ths of an inch.

*Localities.*—Barton, Muddiford (Highcliff). Mr. Sowerby also gives Highgate, but I do not know of any specimen from that locality. The species is, apparently, confined to the upper beds of the middle eocene deposits, and is not common.

### No. 153. PLEUROTOMA FUSIFORMIS, *Sowerby*. Tab. XXVII, fig. 1 *a*, *b*.

PLEUROTOMA FUSIFORMIS, *Sow.* 1823. Min. Con., vol. iv, p. 119, t. 387, fig. 1.
— — *Morris.* 1843. Cat. Brit. Foss., p. 157.
Non PLEUROTOMA FUSIFORMIS, *Sow.* 1831. Trans. Geol. Soc., 2d series, vol. iii, p. 418, t. 39, fig. 20.

*P. testâ elongatâ, fusiformi, angustâ, subturritâ, longitudinaliter costatâ, spiraliter fasciatâ: spirâ elevatâ, acuminatâ: anfractibûs angulatis; ultimo anfractu antice sensim attenuato, in canali longo, lato, terminanti; marginibus posticis concentrice tenuiter lineatis, pauxillulum cavatis; costis rotundatis, ultimo anfractu evanescentibus; fasciis spiralibus numerosis, irregularibus, inæqualibus, lineis incrementi scabratis: aperturâ lanceolatâ; labro arcuato; sinu lato, sub-profundo, in margine collocato.*

Shell elongated, narrow, fusiform, longitudinally ribbed, and spirally banded: the spire, which, in the larger specimen figured, consists of eight volutions exclusive of the pullus, is elevated, forming nearly two fifth parts of the whole length of the shell. The whorls are sharply angulated at the shoulders, giving a turreted appearance to the spire; the posterior margins are moderately wide, slightly depressed, a little thickened and crenulated round the suture, and ornamented with fine, concentric, raised lines, two or three of which, immediately behind the shoulder, are stronger than the rest, and granulated by the lines of growth of the sinus; the longitudinal ribs are rather numerous, rounded, and extend to the middle of the whorls, but become obsolete on the body-whorl of the adult shell; the spiral bands over the middle and front parts of the whorls are numerous, unequal, irregular, becoming more distant on the canal, where occasionally fine, thread-like lines rise between them; the bands are much roughened by the lines of growth, giving a scabrous aspect to the shell: the body-whorl is attenuated very gradually in front, assuming a nearly conical shape, and terminates in a long, rather wide, and nearly straight canal. The aperture is lanceolate, the outer lip moderately arched, and the sinus, which is placed in the margin immediately behind the shoulder, is wide, moderately deep, and almost semicircular in form.

No foreign analogue of this well-marked species has as yet been noticed; and at present *P. fusiformis* appears to be confined to the older eocene strata in the neighbourhood of London, where it is exceedingly rare. Mr. Sowerby, it is true, has applied the name to a Pleurotoma from the so-called transition beds between the lower tertiaries and the upper cretaceous formation at Gosau, a notice of which is contained in a memoir 'On the Structure of the Eastern Alps,' by Prof. Sedgwick and Sir Roderick Murchison, published in the 'Geological Transactions' of 1831; but that shell is a short, wide, strongly costated shell, perfectly distinct in character from the Highgate shell, and the name *fusiformis* was used apparently in forgetfulness of its having been previously applied to the present species. The Gosau shell has been since distinguished by D'Orbigny as *P. sub-fusiformis.*

The specimens figured form part of Mr. Wetherell's collection.

*Size.*—If the larger specimen were perfect, the dimensions would be—axis, 1 inch and 9-12ths; diameter, 6-12ths of an inch. Those of the specimen figured in 'Mineral Conchology' appear to be—axis, 2 inches and 1-12th; diameter, rather more than 7-12ths of an inch.

*Locality.*—Highgate.

### No. 154. PLEUROTOMA SULCULOSA. *F. E. Edwards.* Tab. XXVII, fig. 2 *a—c.*

*P. testâ elongatâ, fusiformi, sub-turritâ, concentrice sulcatâ: anfractibus convexiusculis, angulatis, tuberculatis; marginibus posticis pauxillulum cavatis, transversim interrupte lineatis, ad suturam incrassatis: aperturâ oblongo-ovali, in canali longiusculo exeunti; labro valde arcuato; sinu lato, sub-trigono, in margine collocato.*

*Var. β. Testâ tuberculis longitudinaliter compressis, ultimo anfractu evanescentibus, instructâ.*

Shell elongated, fusiform, transversely sulcated; spire formed of seven or eight volutions, moderately elevated, pointed: whorls rather convex, angulated at the shoulders, where they present a series of oblong, longitudinally compressed, and more or less oblique tubercles; the posterior margins slightly hollowed out, thickened on the sutural edge, round which runs an elevated, sharp line, granulated by the lines of growth of the sinus; the space between this line and the angle of the whorls is occupied by three or four concentric lines, broken into oblong granulations, more or less widely separated by smooth spaces, formed at the successive stages of growth by the margins of the sinus; the angulated shoulders, and somewhat depressed margins of the whorls, give a turreted character to the spire. The tubercles are rather numerous, and prominent in all stages of growth; the transverse furrows deep, but not wide, and separated by rounded ridges, which are narrow near the shoulders, but become broader over the middle and front parts of the whorls, and on the canal. The body-whorl is suddenly contracted near the middle, and produced anteriorly into a wide, moderately long canal. The aperture is of a narrow, oblong, oval shape; the outer lip roundedly arched, almost semicircular in form; and the sinus, which is placed in the middle of the margin, is deep, rather wide, and sub-trigonal.

Specimens occur (*Var.* β, fig. 2 *b*) in which the tubercles are compressed, and a little prolonged, in the direction of the axis, imparting a sub-costellated appearance to the earlier whorls, and becoming obsolete as the shell approaches maturity.

This species presents a very close analogy with *P. fusiformis,* with which, in fact, it may be easily confounded. On comparing the two shells, however, it will be found that, in the present species, the shell is wider; the spire relatively more produced and tuberculated, not costated; the body-whorl more contracted, and less conical, in front; the canal wider and shorter; the outer lip more roundedly arched; and the sinus deeper, more trigonal, and placed nearer the middle of the margin. These distinctions, and the different ornamentation, which consists of deep conspicuous furrows instead of the rough spiral bands which characterise *P. fusiformis,* appear to me to justify the separation.

*Size.*—The dimensions of the largest specimen figured would be, if the shell were perfect—axis, 1 inch and 5-12ths; diameter, not quite half an inch.

*Localities.*—Highgate and Potters' Bar, at both of which localities it is rather scarce.

## No. 155. PLEUROTOMA ACUMINATA, *Sowerby.* Tab. XXVII, fig. 3 *a—d.*

PLEUROTOMA ACUMINATA, *Sow.* 1816. Min. Con., vol. ii, p. 105, t. 146, fig. 4.
— — *D'Orb.* 1850. Index Paléont., vol. ii, p. 359, No. 420.
— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 269.
Nec PLEUROTOMA ACUMINATA, *Nyst.* 1836. Rech. coq. foss. de Hoesselt et Vliermael, p. 32, No. 83.
nec — — *De Kon.* 1837. Desc. des coq. foss. de Basele Boom, &c., p. 24, No. 24.
nec — — *Nyst.* 1843. Bull. Soc. Géol. de France, vol. xiv, p. 454, No. 27.
nec — — *Ib.* 1843. Descr. des coq., &c., de la Belgique, p. 519, t. 42, fig. 1 *a*, *b*.

*P. testâ elongatâ, angustâ, turritâ, acuminatâ, longitudinaliter costatâ, concentrice sulcatâ: anfractibus convexiusculis; marginibus posticis angustis, concavis, transversim granuloso-lineatis, ad suturam plicatis; sulcis concentricis confertis, antice distantioribus; spatiis sulcos separantibus lineis incrementi granulatis: aperturâ oblongo-ovali, in canali lato, longiusculo exeunti; labro arcuato; sinu fere semicirculari, in margine collocato.*

*Var. a.—Testâ latiori, breviori.*

*Var. β.—Testâ lævigatâ; sulcis transversis semi-obliteratis.*

Shell elongated, narrow, turreted, pointed, longitudinally ribbed and concentrically furrowed; the spire, formed of eight or nine volutions, much produced, equalling in length three fifths of the whole shell. The whorls are slightly convex; the posterior margins narrow, channeled, ornamented with several concentric raised lines, a little thickened at the suture, and plicated by the lines of growth of the sinus, which, in some specimens, are prominent over the whole margin, granulating the concentric lines; the last whorl is rather suddenly contracted in front, and terminates in a wide but not very long canal. The furrows in front of the shoulder are close-set, regular and equal, but, where the whorl begins to contract, they become more distant and irregular: the surface of the intervening spaces is granulated by longitudinal ridges formed by the elevated lines of growth; the longitudinal ribs are rather numerous, narrow, and extend to the middle of the whorls. The aperture is of a narrow, oblong-oval form; the outer lip but slightly arched, and the sinus, which is wide and almost semicircular in shape, is placed a little in front of the middle part of the margin. Specimens occasionally occur (*Var. a*, fig. 3 *b, c*) in which the shell is wider and shorter, and the spire is relatively not so much produced; and others, again (*Var. β*, fig. 3 *d*), in which the ribs disappear as the shell is enlarged, the transverse furrows are shallower and more closely set, and the lines of growth less prominent, giving to the surface a levigated appearance, as if it had been rubbed smooth.

MM. Nyst and De Koninck have severally described certain shells from Basele, Boom, and Kleyn-Spauwen, which they have referred, erroneously in my opinion, to the present species. In the general character of the ornamentation these shells apparently agree with the English shells; but with them, judging from the figure given by Nyst, the spire is relatively longer, the whorls more convex, the posterior margins less depressed, giving a more conical and less turreted form to the spire; the body-whorl more suddenly contracted, and the columella more arched: the characters, however, which most clearly distinguish the Belgian shells are the form and position of the sinus, which is wide and very shallow, and is placed on the shoulder, and not, as in the present species, in the margin of the whorls.

*Size.*—Axis, 1 inch and 3-12ths diameter, 4-12ths of an inch.

*Localities.*—Highgate, Hornsey, Potters' Bar, and Clarendon Hill, at which last locality both varieties occur.

The specimens represented by figs. 3 *a* and 3, form part of Mr. Wetherell's collection.

### No. 156. PLEUROTOMA PYRULATA, *Deshayes*. Tab. XXVII, fig. 7 *a, b*.

PLEUROTOMA PYRULATA, *Desh.* 1824–37. Descr. des coq. foss., &c., vol. ii, p. 449, t. 66, figs. 1—3.

*P. testâ elongatâ, angustâ, piruliformi, spiraliter lineatâ: spirâ mediocriter elevatâ, sub-conicâ; anfractibus angulatis, in medio convexiusculis, antice sensim attenuatis; marginibus posticis declivis, vix cavatis, concentrice tenuissime lineatis; ultimo anfractû in canali præ-longo terminanti; lineis spiralibus acutis, irregularibus, inæqualibus, lineis incrementi fortiter decussatis: aperturâ elongato-ovali; labro parum arcuato; sinu latiusculo, profundo, in margine collocato.*

Shell elongated, narrow, concentrically lined: the spire, formed of eight or nine volutions, is pointed and moderately elevated, not equalling in length a third part of the whole shell; the whorls are convex at the middle, bluntly angulated at the shoulders; the posterior margins but slightly depressed, giving a nearly conical form to the spire; slightly thickened at the edge, where they present two strong, prominent, raised lines, which run round the suture, and form a border to the whorls; the space between the suture and the shoulders is slightly channeled, and covered with several very slender, unequal, raised lines; the body-whorl diminishes gradually towards the base, and terminates in a very long and nearly straight canal. The gradual tapering of the whorls, joined to the rather short, conical spire, gives to the shell somewhat of the form of a long, narrow pear, from which appearance the specific name is taken. The spiral lines over the middle and front parts of the whorls are numerous, irregular, and unequal, slender thread-like lines alternating with thicker and more prominent lines; all are beautifully and regularly decussated by the strongly marked lines of growth. The aperture is of a long, narrow, oval form; the outer lip slightly expanded towards the middle; and the sinus, which is placed in the middle of the margin is deep and not very wide.

The French shells, in their typical form, are narrow, with a rather short spire; but, apparently, specimens from different localities present considerable variations, not only in the relative height of the spire and width of the shell, but also in the striation. The specimens from Compiègne, for instance, as M. Deshayes has recorded, have the spire more produced, the angle of the whorls more prominent, and the concentric lines more numerous; and in some specimens from Cuise-Lamotte, in my cabinet, the spire is also much elevated, the shell relatively narrower, and the concentric lines close-set, slender, and regular. In the English specimens the relative height of the spire and the character of the concentric lineation agree with those of the specimens from Compiègne; but the shell is wider, and the margins of the whorls are not so much depressed. These differences, however, attributable probably to local conditions only, do not suggest a doubt of the correctness of the identification.

*Size.*—Axis, rather more than 5-6ths of an inch (11 millim.); diameter, 3-12ths of an inch (rather more than 6 millim.).

*Localities.*—Clarendon Hill. French—Compiègne (fide *Desh.*); Cuise-Lamotte, Trosly-Breuil (fide *Graves*); Laon (fide *Mellev.*) MM. Deshayes and D'Orbigny also give Parnes; but M. Graves speaks with doubt of that locality.

### No. 157. PLEUROTOMA TEREBRALIS, *Lamarck*, var. Tab. XXVII, figs. 10 *a—k.*

PLEUROTOMA TEREBRALIS, ***Lamk.*** 1804. Anm. du Musée, vol iii, p. 266, No. 20.
— — ***Ib.*** 1822. Hist. nat., &c., vol. vii, p. 101, No. 25.
— — ***De Blainv.*** 1826. Dict. des sci. nat., vol. xli, p. 391.
— — ***Desh.*** 1832. Encl. méth. (Vers.), vol. iii, p. 799, No. 21.
— — ***Ib.*** 1824-1837. Desc. des coq., &c., vol. ii, p. 455, t. 62, figs. 14—16.

*Var.* 1st. DITROPIS; fig. 10*a*. *P. testá parvulá, elongatá, fusiformi, angustá, turritá, lineis spiralibus elegantissime granulatis ornatá; spirá elevatá, acuminatá; anfractibus bicarinatis; marginibus posticis depressis, concavis, ad suturam granulatis, cæteris lævibus, vel tenuissime plicatis; cariná posticá acutá, denticulatá; cariná anticá fascioli-formi, denticulato-plicatá; lineis spiralibus plus minusve distantibus, inæqualibus; ultimo anfractu antice valde attenuato in canali longo exeunti; sinu lato, fere semicirculari, in margine collocato.*

*Var.* 2d. CONCINNA; fig. 10 *i, k.* *Testá parvá, bicarinatá, lineis spiralibus peræque granulatis, undique, etiam in marginibus anfractuum, ornatá; cariná anticá granulatá; lineis spiralibus numerosis.*

*Var.* 3d. GYRATA; fig. 10 *b, d.* *Testá bicarinatá; carinis fascioli-formibus, crassis, oblique plicato-denticulatis; lineis spiralibus inæqualibus, granulosis.*

*Var.* 4th. PULCHERRIMA; fig. 10 *e.* *Testá parvá, bicarinatá; cariná posticá denticulatá; cariná anticá rotundatá, lævi; lineis spiralibus elevatis, rotundatis, simplicibus vel obsolete granulatis, suprá canalem confertis, cæteris distantibus.*

*Var.* 5th. REVOLUTA; fig. 10*f.* *Testá bicarinatá; marginibus posticis anfractuum ad suturam lævissime crenulatis; cariná posticá acutá, obsolete plicato-denticulatá, superne revolutá; cariná anticá lineisque spiralibus granulatis.*

*Var.* 6th. PAGODA; fig. 10 *h.* *Testâ latiori, fasciolis et lineis spiralibus elevatis cinctâ: anfractibus bicarinatis, ad suturam marginatis; carinis simplicibus, singulis unico sulco exaratis; carinâ posticâ superne revolutâ; fasciolis numerosis, inæqualibus, lævibus.*

The typical form of this elegant Pleurotoma is distinguished by the smooth concave margins of the whorls, by the remarkable regularity of the denticulation on the keel, resembling the teeth of a circular saw, and by the close-set rows of even, bead-like granulations, which cover the middle and front parts of the shell, slightly diminishing in size as they approach the anterior extremity of the canal. The shell, upon which Lamarck formed the species, was found at Parnes; and, apparently, the ornamentation which characterises it is confined in the French specimens to those from the "calcaire grossier." The species occurs, also, in the older eocene formations of that country; but the shells from them are generally of smaller dimensions, and present more or less strongly marked deviations from the typical ornamentation. In England the species has not as yet been found above the older eocene deposits; several forms, indeed, occur in them; one or two of which apparently agree with French varieties; but neither among them, nor, as I believe, among those from the "groupes glauconieux" of France, does the exact ornamentation of the typical *P. terebralis* of Lamarck occur.

In the first variety (*ditropis*), which corresponds with specimens in my cabinet from Cuisse-Lamotte, the shell is much smaller than that of the type, elongated, fusiform, narrow, turreted, and beautifully ornamented with concentric rows of regular bead-like granulations; the spire is pointed and much produced, being rather more than two fifths of the length of the whole shell. The whorls are somewhat convex, sharply angulated, and carinated at the shoulders; the posterior margins rather depressed, slightly channeled, and perfectly smooth, except round the suture, where they are bordered by a single row of small regular granulations; occasionally a specimen occurs in which the smoothness of the surface is broken by very fine curved plications formed by the successive margins of the sinus. The keel on the shoulder is sharp, prominent, and denticulated with great regularity: in front of this, just where the whorl begins to contract, is a thick concentric band, rather obliquely plicated, and so prominent as to present the appearance of a second keel on the whorl; the ends of the plications project beyond the edges of the band, giving to it a denticulated appearance. The concentric rows are unequal, irregular, and more or less distant in different specimens, but closer and more regular towards the anterior extremity. The last whorl is much attenuated in front, and terminates in a moderately long canal: the sinus is rounded, deep, and wide, occupying almost the entire width of the margin.

In the next variety (*concinna*) the shell is somewhat larger than that of the preceding variety, but yet smaller than that of the type; the front keel is narrower and less prominent than in the variety *ditropis*, and is evenly granulated; the concentric rows of granulations are more numerous, and the margins of the whorls present, in addition to the sutural row of beads, three very slender concentric lines granulated by the lines of growth of the sinus. It has been before stated that one of the more prominent characters of the true *P. terebralis* is taken from the perfectly smooth concave margins of the whorls; and the granulated margins in the present case would apparently indicate a distinct species; but the occasional occurrence of a plicated margin in the last variety prepares the way for the present form; and as this agrees in all the more important characters with the variety *ditropis*, I have regarded it as merely another variety of *P. terebralis.*

The shell in the variety *gyrata* (fig. 10 *b*—*d*) is smaller than that of the type, and doubly keeled; but both keels are thick, band-like, and strongly and obliquely plicated, and have a denticulated appearance from the plications being continued over the edges of the bands; the plications, following the curve of the line of growth, are less oblique on the anterior keel than those on the posterior keel. A single slender raised line, finely granulated, traverses the space between the keels; the front part of the whorl is ornamented with several concentric raised lines, granulated with great regularity; of these, the one next to the anterior keel, in some specimens (as in fig. 10 *b*), and that next but one, in others (as in figs. 10 *c* and *d*), is the thickest and most prominent; the others slightly diminish in size as they approach the anterior extremity of the canal.

The next variety, *pulcherrima* (fig. 10 *e* and *g*),* appears to correspond with the variety *a* from Compiègne, noticed by M. Deshayes. In this variety the shell is small and doubly-keeled; the posterior or shoulder-keel denticulated, the anterior keel rounded and obscurely plicated, almost smooth; the front part of the whorls is ornamented with several distant, thickish, concentric lines, which also are smooth and simple, or but very feebly granulated; the whorls are bordered round the suture by a thickish raised line, obscurely granulated or plicated; the margins and the spaces between the keels and between the concentric lines are perfectly smooth.

The variety *revoluta* (fig. 10 *f*) is a modification of the variety *pulcherrima;* in it the sutural edges of the whorls are very faintly crenulated; the shoulder-keel is sharp, obscurely plicated and denticulated, and the edge is bent upwards: the anterior keel is round and feebly plicated, and the concentric lines are slender and finely granulated.

In the last variety to be noticed, the variety *Pagoda* (fig. 10 *h*), the granulation and denticulation, which in the typical form and the preceding varieties form more or less prominent characters, are wanting; and a new mode of ornamentation prevails. In this variety the shell, which is relatively wider, is doubly-keeled, and ornamented with simple spiral bands; the margins of the whorls are concave, and quite smooth, except where two slender, faintly crenulated, raised lines form a border round the suture. The keels are band-like and simple; the surface of each is traversed by a shallow but conspicuous furrow; the edge of the shoulder-keel is sharp, smooth, and bent upwards like that of the keel which characterises the preceding variety. The space between the two keels and the surface of the front part of the whorls is ornamented with numerous narrow, unequal, round-edged bands, between some of which a slender line occasionally appears; these bands are smooth, or but slightly roughened by the lines of growth.

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* I have adopted for the shells forming this variety, the name by which they have been distinguished as a species in Mr. Wetherell's cabinet.

A form intermediate between and connecting the last two varieties occurs, in which the sharp, smooth-edged, and furrowed shoulder-keel of the variety *Pagoda* is associated with an obscurely plicated anterior keel, and faintly granulated spiral lines.

Although the shell for which the variety *Pagoda* is proposed, differs so much in the ornamentation from the typical form, I do not regard it as specifically distinct. In the several varieties described, the characteristic ornaments of the species have been modified, and have become gradually less prominent, until at last, in the variety *revoluta*, they are almost obliterated; and the intermediate form, before noticed, connects that variety with the one in question, which, in fact, merely presents in strength a character of ornament which has already appeared in other varieties.

All the varieties are rare except the varieties *gyrata* and *Pagoda*, which appear to be more abundant.

*Size.*—Of the var. *ditropis*—axis, 5-12ths of an inch; diameter, 2-12ths of an inch: of the var. *concinna* and *pulcherrima*—axis, 7-12ths of an inch; diameter, rather more than 3-12ths of an inch: of the var. *gyrata*—axis, 1 inch, nearly; diameter, rather more than 5-12ths of an inch: and of the var. *Pagoda*, if the shell were perfect—axis, 1 inch and 2-12ths, nearly; diameter, 5-12ths of an inch.

*Localities.*—For the var. *ditropis*—Highgate, Potters' Bar, Hornsey, Hampstead; for the var. *concinna*—Highgate, Potters' Bar, Hornsey, Finchley; for the var. *gyrata*—Hornsey, Southampton, Shenfield; for the var. *pulcherrima*—Highgate and Clarendon Hill; and for the var. *revoluta* and *Pagoda*—Clarendon Hill. *French*—Parnes, Grignon, Beyne, Mouchy-le-Châtel, Compiègne (fide *Desh.*), Chaumont, Amblainville, Cuisse-Lamotte, Pont-Sainte-Maxence (fide *Graves*).

The specimens, fig. 10 *b* and *k*, are from Mr. Wetherell's cabinet.

### No. 158. PLEUROTOMA MICRODONTA, *F. E. Edwards*. Tab. XXVII, fig. 4.

*P. testá elongatá, fusiformi, tuberculatá, spiraliter exilissime lineatá: spirá elevatá, b-conicá: anfractibus angulatis, unicá serie tuberculorum denti-formium munitis; marginibus posticis latis, pauxillum cavatis, ad suturam cingulo triplici, distanter plicato, cinctis:*

*ultimo anfractu antice repentissime coarctato, in canali angusto, longiusculo, terminanti; lineis spiralibus confertis, inæqualibus, nonnullis eminentioribus, denticulatis: apertura oblongo-ovali; labro valde arcuato, intus plicato; sinu lato, sub-trigono, in margine collocato.*

Shell elongated, fusiform, tuberculated, and ornamented with very fine, concentric, raised lines; spire nearly conical and much produced, exceeding one half of the whole shell in length; whorls convex, sharply angulated at the shoulders, where they present a single row of small, rather close-set, tooth-shaped tubercles; the posterior margins wide, frequently extending almost to the angle of the preceding whorl, slightly channeled, and bordered round the suture by three sharp, elevated lines, crossed by distant, oblique plications, corresponding with the tubercles on the shoulders of the whorls; the space between the suture and the shoulder is covered with very fine and nearly equal concentric lines. The spiral lines over the middle and front parts of the lines are numerous, very slender, but unequal; every fourth or fifth line being rather thicker and more prominent than the rest, and denticulated; the intermediate lines are simple, nearly equal, and so fine as to be barely perceptible by the naked eye. The body-whorl is suddenly much contracted in front, and terminates in a narrow, but not very long canal: the aperture is of an oblong oval form; the outer lip much arched and plicated within, and the sinus, which is wide and sub-trigonal in shape, is placed a little in front of the middle part of the margin.

The present species presents some resemblance to *P. cymæa*, but is easily distinguishable by the more elevated spire, the more numerous and smaller tubercles, the character of the transverse ornamentation, and the shorter canal.

*Size.*—Axis, 1 inch and 2-12ths; diameter, 5-12ths of an inch, nearly.

*Localities.*—Highcliff, where it is very abundant, and Bracklesham Bay.

### *Section* I—*Shells fusiform.*
### A. *Sinus in the posterior margin of the whorl.* } continued.
### *b. Canal short or indistinct.*[*]

### No. 159. Pleurotoma attenuata, *Sowerby.* Plate XXVII, fig. 6 *a—c.*

Pleurotoma attenuata, *Sow.* 1816. Min. Con., vol. ii, p. 103, t. 146, fig. 1.
— — *Ib.* 1850. Dixon's Geol., &c., of Sussex, p. 102, t. 6, figs. 11, 14.
— — *Morris.* 1854. Cat. Brit. Foss., 2d edit., p. 269.

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[*] The sub-divisions dependent on the length of the canal are, it is unnecessary to say, merely artificial, and towards the extremes of the two, species occur which may be referred, apparently with equal propriety to either sub-division: in shells with a short canal, however, the anterior notch is generally wider and deeper, and consequently the crest on the columella will be more prominent.

Nec Pleuromoma attenuata, *Desh.* 1824–37. Descr. des coq. foss., &c., vol. ii, p. 483, t. 68, figs. 6, 8.
nec — — *Dujar.* 1837. Mém. Soc. Géol. de France, vol. ii, p. 291, t. 20, fig. 22.

*P. testâ elongato-fusiformi, turritâ, costatâ, undique spiraliter lineatâ: spirâ elevatâ, acuminatâ: anfractibus angulatis, unicâ serie nodorum spiniformium, costas coronantium, armatis; marginibus posticis latis, declivis, concavis, ad suturam pauxillum incrassatis, tenuiter crenulatis; ultimo anfractu antice sensim attenuato, in canali longiusculo, lato, terminanti; costis brevibus, sub-distantibus, rotundatis; lineis spiralibus numerosis, in marginibus tenuibus; cetæris inæqualibus: aperturâ lanceolatâ; labro arcuato; sinu lato, subtrigono, in margine collocato.*

Shell elongated, fusiform, turreted, longitudinally ribbed, and ornamented with concentric raised lines: the spire, formed of eleven or twelve volutions exclusive of the pullus, is much elevated and pointed; the whorls, angulated at the shoulders, are gradually attenuated towards the base, assuming an almost conical form; the body-whorl terminates in a wide, moderately long canal, rather deeply notched at the anterior extremity; the posterior margins are wide, slightly bent towards the preceding whorls, channeled along the middle, thickened at the sutural edge, and bordered by two thickish, prominent, raised lines, granulated or feebly plicated by the lines of growth. The ribs are rather distant, short, oblique, rounded, and terminate at the shoulder in large, transversely compressed, spiniform tubercles, the bases of which are frequently prolonged backwards half-way across the posterior margin. The whole surface of the whorls is covered with close-set concentric raised lines, which are thread-like and nearly equal on the margins, but irregular and unequal over the middle and front parts of the whorls; one or two more or less slender lines intervening between thicker and more prominent lines: the whole surface is roughened by the lines of growth, which in the Bracklesham Bay specimens are very prominent, and give a coarse, rugged character to the shell. The aperture is of a long, narrow, lanceolate form; the outer lip moderately arched; and the sinus, which is wide, not very deep, and sub-trigonal in shape, is placed in the margin. The columella is nearly straight, and presents a large prominent crest or comb at the anterior extremity.

M. Deshayes (*loc. cit.*) has given the specific name *attenuata* to certain shells from the older eocene beds of France, quite distinct from the present species, to which, in point of priority, the name belongs; and Dujardin has fallen into the same error with regard to a Pleurotoma from Touraine. D'Orbigny, in his 'Prodrome,' has distinguished the French eocene shells by the name *sub-attenuata,* and the miocene shells by that of *pseudo-attenuata.*

*Size.*—Axis, 4 inches, nearly; diameter, 1 inch and 2-12ths.

*Localities.*—Although Mr. Sowerby (Dixon's 'Sussex,' p. 102) and Mr. Morris both cite Barton as a locality for this well-marked species, I have not been fortunate enough to meet with any specimen of it from that locality; it is confined, I believe, to the lower beds of the middle eocene formations. It is found plentifully at Bracklesham Bay, of which locality it may be said to be one of the characteristic fossils: it also occurs at Stubbington and White-Cliff Bay, and in the synchronous beds at Bramshaw.

### No. 160. PLEUROTOMA CONICA, *F. E. Edwards* Tab. XXVII, fig. 8.

*P. testâ elongatâ, fusiformi, omnino concentrice sulcatâ, unicâ serie tuberculorum munitâ; spirâ conicâ, elevatâ, dimidium totius testæ in longitudine superanti: anfractibus convexiusculis, antice subito coarctatis, suturâ conspicuâ separatis; marginibus posticis latis, pauxillulum declivis, cavatis; ultimo anfractu in canali longiusculo terminanti; tuberculis longitudinaliter compressis, obliquis, curvis: aperturâ oblongo-ovali; labro arcuato; sinu lato, sub-trigono, in parte anticâ marginis collocato.*

Shell elongated, fusiform, concentrically furrowed, and bearing on the shoulders a single row of tubercles: the spire conical, rather thick, and much elevated, exceeding one half of the whole shell in length. The whorls are slightly convex at the shoulders, rather suddenly contracted in front, and separated from each other by a very conspicuous suture; the posterior margins are wide, very slightly depressed, rather deeply channeled along the middle, and a little thickened on the sutural edge. The tubercles, which are somewhat numerous, are longitudinally compressed, narrow, oblique, and curved; the concentric furrows are nearly regular, shallow, and separated by narrow, rounded ridges, of which, as they approach the beak, every alternate one becomes more prominent than the rest. The aperture is of an oblong-oval form, and terminates in front in a slightly produced, widish canal; the outer lip is moderately arched; and the sinus, which is placed in the very front part of the posterior margin, almost on the shoulder of the whorl, is wide and sub-trigonal in shape.

This species, characterised by its thick, elevated, conical spire, is apparently confined to the older eocene beds in the neighbourhood of London. I have not met with any specimen of it either from Clarendon Hill or from the synchronous formations in Hampshire.

*Size.*—Axis, 11-12ths of an inch; diameter, 4-12ths of an inch.

*Locality.*—Highgate.

### No. 161. Pleurotoma desmia, *F. E. Edwards.* Tab. XXVII, fig. 5.

*P. testá elongatá, fusiformi, tuberculatá, spiraliter fasciolatá et lineatá: spirá subconicá, valde productá: anfractibus convexis, sub-angulatis, longitudinaliter plicatis; marginibus posticis depressis, concavis, concentrice lineatis, ad suturam cingulo duplici, distanter plicato, cinctis; ultimo anfractu repente coarctato, incanali breviculo exeunti: fasciolis numerosis, antice simplicibus, cæteris inæqualibus, nonnullis majoribus, crasse granulatis, cum aliis minoribus simplicibus, alternantibus: apertura ovali; labro valde arcuato, intus plicato; sinu lato, sub-trigono, in margine collocato.*

Shell elongated, fusiform, tuberculated, and ornamented with concentric bands and raised lines; the spire rather thick, nearly conical and much elevated, almost equalling two thirds of the whole shell in length: the whorls short, convex, and obscurely angulated at the shoulders, where they present a double row of small, transverse tubercles; the posterior margins much depressed, hollowed out, and concentrically lined along the middle, and bordered round the suture by a double line, distantly and obliquely plicated by the lines of growth of the sinus, which are very prominent over the whole width of the margin; the last whorl is suddenly contracted in front, and terminates in a rather short and narrow canal, widely notched at the anterior extremity. The spiral bands over the middle and front parts of the whorls are divided with much regularity into rows of coarse, oblong granulations, placed nearly below each other in an oblique direction, following the curve of the outer lip, and giving an appearance of plication to the whorl: the rows of granulations, which are separated by thickish, raised lines, rounded on the surface, diminish in size towards the front part of the whorls, until, on reaching the canal, they barely exceed the intervening lines in size, and the granulations become nearly obliterated. The aperture is of an oval form; the outer lip much arched, projecting in front, and plicated within; and the sinus, which is placed rather towards the front of the margin, is wide, moderately deep, and sub-trigonal in form. The columella is slightly curved, and presents in front, at the anterior extremity, a conspicuous crest or comb.

The present species, in the young state, somewhat resembles *P. microdonta*, but the shell is narrower, the spire relatively longer, and the canal shorter; the regular granulations which characterise the concentric ornamentation also render it easily separable. It is apparently confined to the middle eocene formations of Barton, where it is not uncommon.

*Size.*—Axis, 1 inch and 8-12ths, nearly; diameter, half an inch.

## TAB. XXIV.

Fig.

1. Mitra parva, No. 120, *p.* 183.
    - *a.* Back view, natural size.
    - *b.* Back view, magnified.
    - *c.* Front view, ditto.
2. Mitra parva (var. *pumila*). No. 120, *p.* 183.
    - *a.* Back view, natural size.
    - *b.* Back view, magnified.
    - *c.* Front view, ditto.
3. Mitra labratula. No. 119, *p.* 182.
    - *a.* Back view.
    - *b.* Front view.
4. Mitra obesa. No. 122, *p.* 185.
    - *a.* Back view, natural size.
    - *b.* Back view, magnified.
    - *c.* Front view, natural size.
    - *d.* Front view, magnified.
5. Mitra volutiformis. No. 123, *p.* 186.
    - *a.* Back view, natural size.
    - *b.* Back view, magnified.
    - *c.* Front view, ditto.
6. Mitra scabra, No. 118, *p.* 181.
    - *a.* Front view, shell of mid-growth.
    - *b.* Front view, adult shell.
    - *c.* Back view, ditto.
7. Mitra porrecta. No. 121, *p.* 185.
    - *a.* Front view, natural size.
    - *b.* Front view, magnified.
    - *c.* Back view, ditto.
8. Conus diadema. No. 124, *p.* 190.
    - *a.* Back view, shell of mid-growth.
    - *b.* Back view, adult shell.
    - *c.* Front view, ditto.
    - *d.* Back view, ditto. (Var. *pyriformis.*)
9. Conus scabriculus. No. 129, *p.* 198.
    - *a.* Front view.
    - *b.* Back view.
    - *c.* Side view.

## TAB. XXIV (*continued*).

Fig.

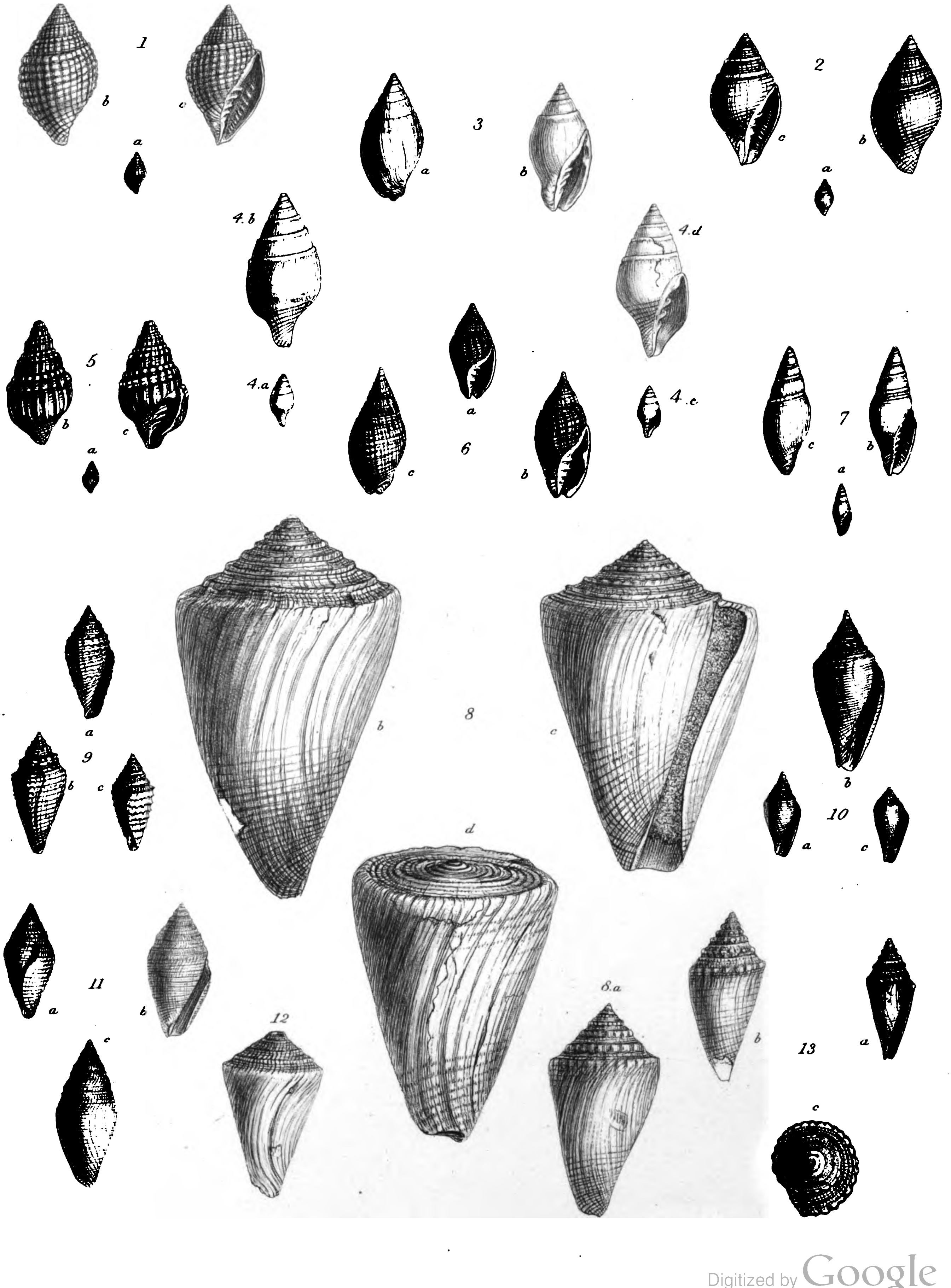
10. Conus lineatus. No. 130, *p.* 199.
    - *a.* Front view, natural size.
    - *b.* Front view, magnified.
    - *c.* Front view, (specimen described as *C. corculum*, Sow.)

11. Conus dormitor. No. 131, *p.* 200.
    - *a.* Side view.
    - *b.* Front view.
    - *c.* Back view.

12. Conus velatus. No. 126, *p.* 193.
    - Back view.

13. Conus concinnus. No. 128, *p.* 196.
    - *a.* Front view, shell of mid-growth.
    - *b.* Back view, adult shell.
    - *c.* View from above, showing the posterior margins of the whorls forming the spire.

Tab. XXIV.



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## TAB. XXV.

Fig.

1. Conus alatus. No. 132, *p*. 202.
    - *a.* Back view.
    - *b.* Side view.

2. Conus deperditus. No. 125, *p*. 191.
    - *a.* Back view, young shell.
    - *b.* Front view, shell of mid-growth.
    - *c.* Side view, adult shell.

3. Conus Lamarckii. No. 127, *p*. 194.
    - *a.* Side view, young shell, from Bracklesham Bay.
    - *a.** Back view, adult shell, from ditto.
    - *b.* Front view, adult shell, from ditto.
    - *b.** Front view, adult shell, from Bramshaw.
    - *c.* Back view, adult shell, from ditto.

4. Pleurotoma stena. No. 133, *p*. 207.
    - *a.* Back view, young shell, from Southampton.
    - *b.* Back view, adult shell, from Highgate.

5. Pleurotoma symmetrica. No. 136, *p*. 209.
    - *a.* Front view, young shell, from Highgate.
    - *b.* Back view, adult shell, from Southampton.

6. Pleurotoma inarata. No. 134, *p*. 208.
    Side view, adult shell.

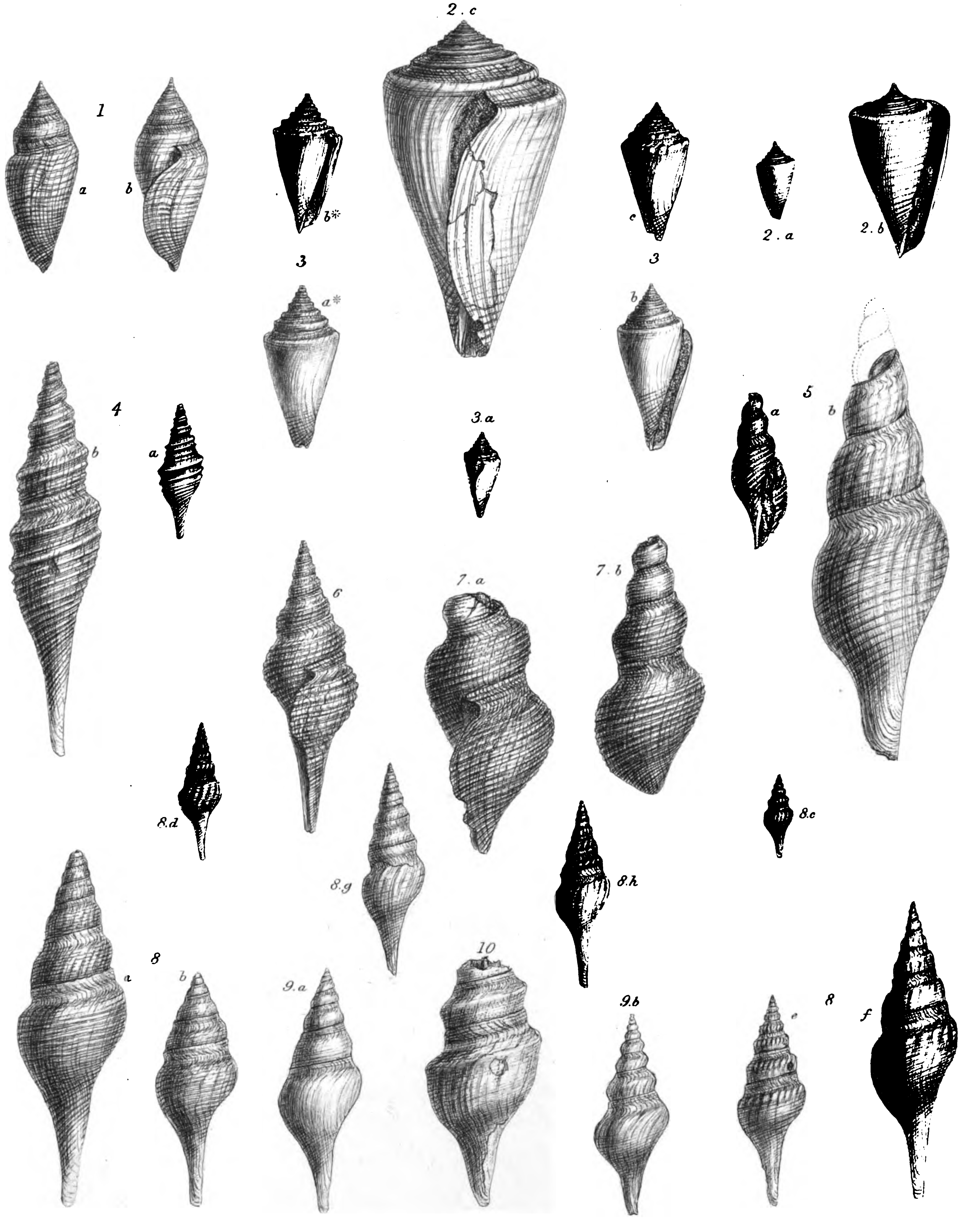
7. Pleurotoma helix. No. 135, *p*. 209.
    - *a.* Side view, adult shell.
    - *b.* Side view, shell of mid-growth.

8. Pleurotoma teretrium. No. 137, *p*. 210.
    - *a.* Back view, adult shell, from Highgate.
    - *b.* Back view, adult shell, from ditto. (Var. *nanodis.*)
    - *c.* Back view, young shell, from Southampton. (Var. *tuberculata.*)
    - *d.* Back view, young shell, from ditto. ditto.
    - *e.* Back view, shell of mid-growth, from ditto.
    - *f.* Back view, adult shell, from Highgate. (Var. *crebrilinea.*)
    - *g.* Back view, Highgate specimen. (Var. *latimarginata.*)
    - *h.* Back view, ditto. ditto.

9. Pleurotoma transversaria. No. 141, *p*. 214.
    - *a.* Back view, Brockenhurst specimen.
    - *b.* Back view, Lyndhurst specimen. (Var. *cypha.*)

10. Pleurotoma goniæa. No. 140, *p*. 213.
    Back view.

Tab. XXV.



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## TAB. XXVI.

Fig.

1. Pleurotoma crassa. No. 138, *p*. 212.
- *a*. Back view, young shell, from Southampton.
- *b*. Back view, shell of mid-growth, from Shenfield.
- *c*. Back view, ditto, from Shenfield.
- *d*. Back view, adult shell, from Nuneham.

2. Pleurotoma cocciphora. No. 143, *p*. 217.
Back view, adult shell.

3. Pleurotoma planetica. No. 139, *p*. 212.
Back view, shell of nearly full growth, from Bramshaw.

4. Pleurotoma cymæa. No. 142, *p*. 215.
- *a*. Back view, shell of mid-growth, from Brockenhurst.
- *b*. Back view, adult shell, from ditto.

5. Pleurotoma dentata. No. 146, *p*. 220.
Back view.

6. Pleurotoma Keelei. No. 145, *p*. 219.
Back view, nearly adult shell, from Shenfield.

7. Pleurotoma textiliosa. No. 147, *p*. 222.
Side view, shell from Bracklesham Bay.

8. Pleurotoma rostrata. No. 144, *p*. 218.
- *a*. Side view, shell past mid-growth, from Barton.
- *b*. Back view, adult shell, from ditto.
- *c*. Front view, adult shell, from Highcliff. (Var. *antiqua*.)

9. Pleurotoma lævigata. No. 152, *p*. 227.
- *a*. Side view, shell of mid-growth, from Barton.
- *b*. Back view, adult shell, from ditto.

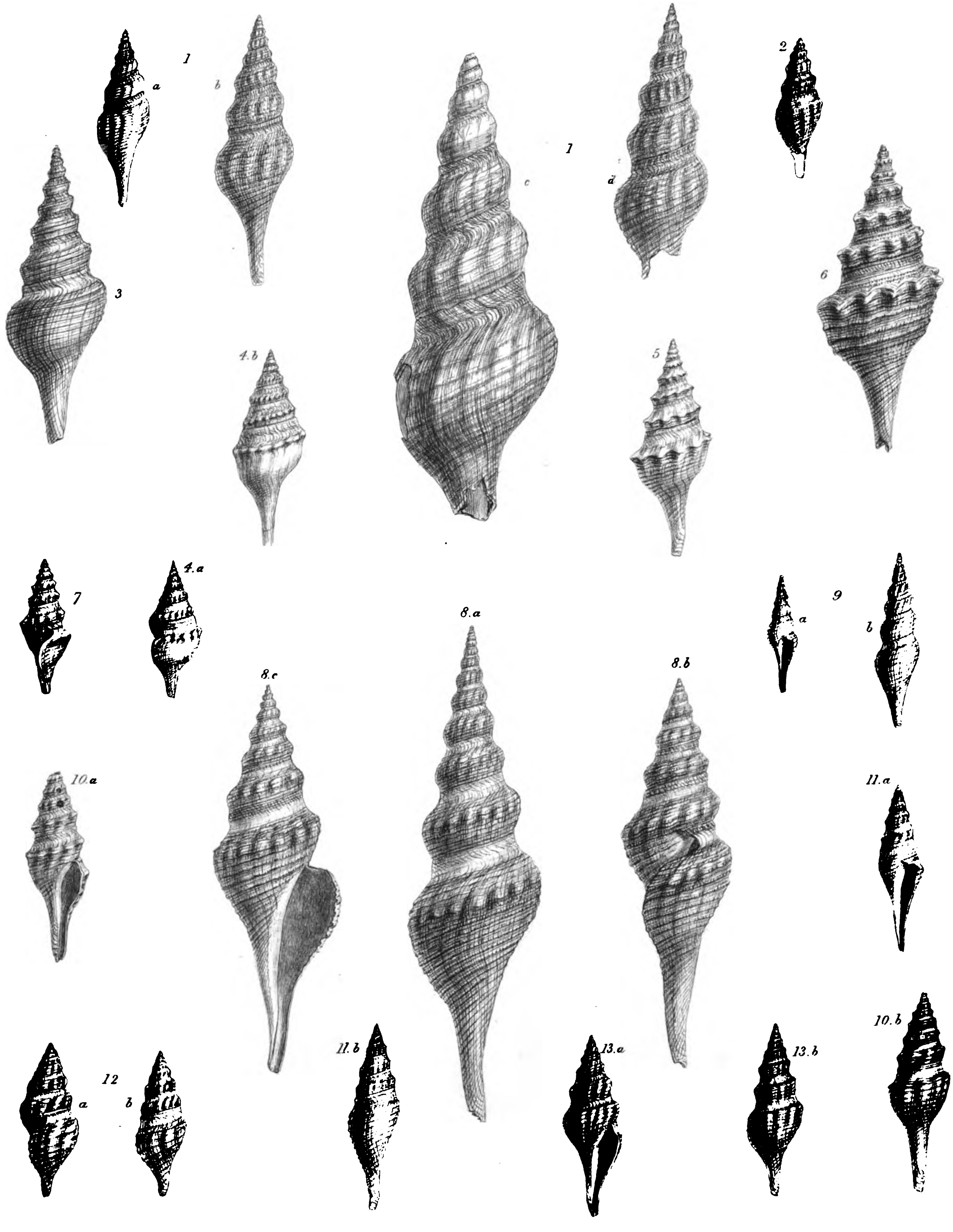
10. Pleurotoma crassicosta. No. 150, *p*. 225.
- *a*. Front view, adult shell.
- *b*. Back view, ditto.

11. Pleurotoma lanceolata. No. 151, *p*. 226.
- *a*. Front view, adult shell.
- *b*. Back view, ditto.

12. Pleurotoma exorta. No. 148, *p*. 223.
- *a*. Side view, adult shell.
- *b*. Back view, ditto.

13. Pleurotoma macilenta. No. 149, *p*. 224.
- *a*. Front view, adult shell, from Barton.
- *b*. Back view, adult shell, from ditto.

Tab. XXVI



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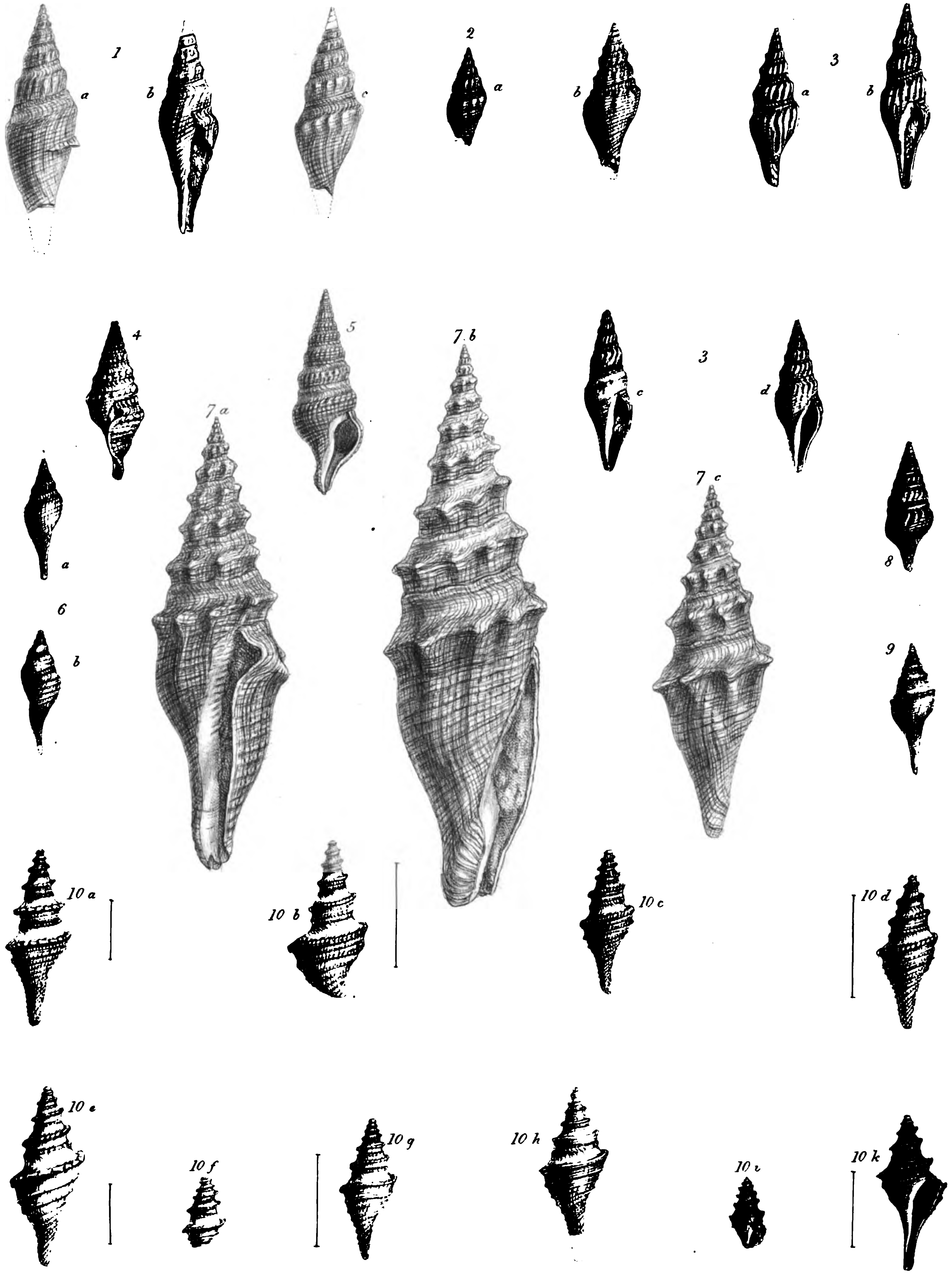
## TAB. XXVII.

Fig.

1. Pleurotoma fusiformis. No. 153, *p.* 228.
    - *a.* Back view.
    - *b.* Front view.
2. Pleurotoma sulculosa. No. 154, *p.* 229.
    - *a.* Back view, young shell, from Potters' Bar.
    - *b.* Back view, shell of mid-growth, from ditto.
    - *c.* Back view, adult shell, from Highgate.
3. Pleurotoma acuminata. No. 155, *p.* 230.
    - *a.* Back view, adult shell, from Highgate.
    - *b.* Front view, adult shell, from ditto.
    - *c.* Front view, adult shell, from Hornsey, smooth variety.
    - *d.* Front view, adult shell, from Clarendon Hill.
4. Pleurotoma microdonta. No. 158, *p.* 236.
    - Side view, adult shell, from Highcliff.
5. Pleurotoma desmia. No. 161, *p.* 240.
    - Front view, shell nearly adult.
6. Pleurotoma pyrulata. No. 156, *p.* 232.
    - *a.* Back view, adult shell.
    - *b.* Side view, ditto.
7. Pleurotoma attenuata. No. 159, *p.* 232.
    - *a.* Side view, shell nearly adult.
    - *b.* Side view, adult shell.
    - *c.* Back view, shell of mid-growth.
8. Pleurotoma conica. No. 160, *p.* 239.
    - *a.* Back view, adult shell.
9. Pleurotoma cymæa. No. 142, *p.* 215.
    - *a.* Back view, young shell, from Colwell Bay.
10. Pleurotoma terebralis, *var.* No. 157. *p.* 233.
    - *a.* Back view, shell magnified (var. *ditropis*), from Hampstead.
    - *b.* Back view, shell magnified (var. *gyrata*), from Hornsey.
    - *c.* Back view, shell natural size (var. *gyrata*), from Shenfield.
    - *d.* Back view, shell magnified (var. *gyrata*), from Southampton.
    - *e.* Back view, shell magnified (var. *pulcherrima*), from Highgate.
    - *f.* Back view, shell natural size (var. *revoluta*), from Clarendon Hill.
    - *g.* Back view, shell magnified (var. *pulcherrima*), from ditto.
    - *h.* Back view, shell natural size (var. *Pagoda*), from ditto.
    - *i.* Front view, shell natural size (var. *concinna*), from Potters' Bar.
    - *k.* Front view, shell magnified (var. *concinna*), from Highgate.

NOTE.—The lines indicate the size of the specimens.

Tab. XXVII.



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